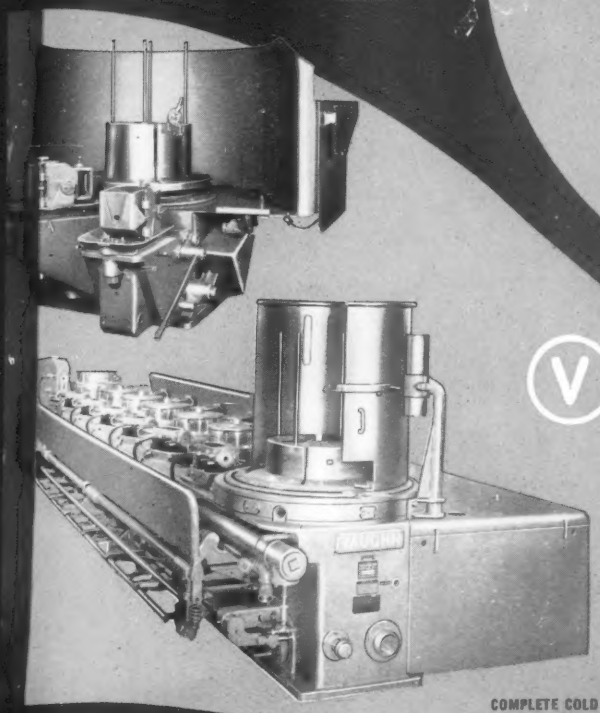
WIRE AND WIRE PRODUCTS

MAY 1959

OVER
2,500
VAUGHN®
MOTOBLOC®
and
MOTOBLOX®

-are at work producing
TOP QUALITY WIRE
throughout the industry today



VAUGHN Motoblocs and Motoblox blanket the quality area of the wire industry—*on merit!* Decade after decade, the top advances in speed, cooling, flexibility and versatility have been set by Vaughn, and year after year the productivity of Vaughn equipment has paced the demands of its users. ● Planning expansion? Call Vaughn!

THE VAUGHN MACHINERY CO.
Cuyahoga Falls, Ohio, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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ANNOUNCES THE WIRE INDUSTRY'S MOST VERSATILE TAKE-UP & WIRE PACKAGING MACHINE!

Vari-Coil

For PATENTING
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GALVANIZING
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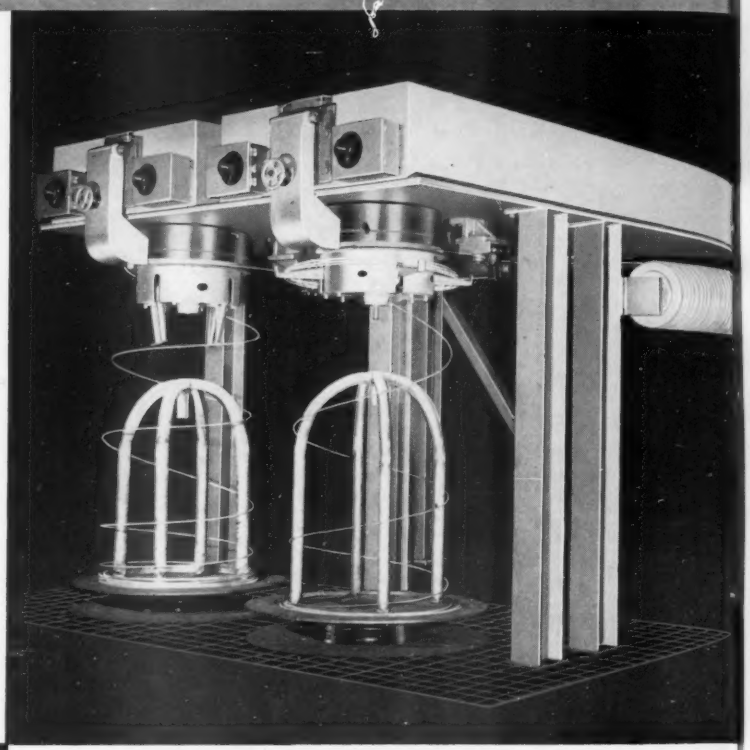
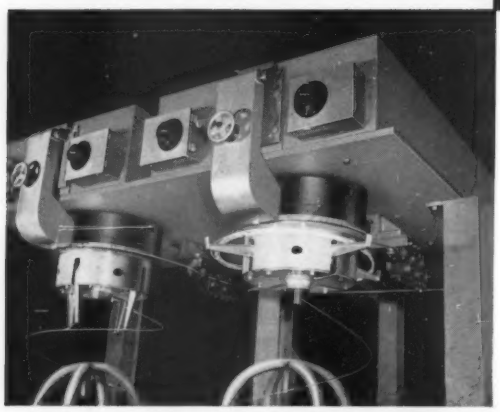
TINNING
FINAL DRAW

- √ Non-Stop Package Changing
- √ Package Sizes to 4,000 lbs.
- √ Coil Diameters to 36″
- √ Speeds Infinitely Variable
- √ Wire Size to ⅜″ (.375″)
- √ Ferrous and Non-Ferrous Materials Including High Carbon Steel

THERE IS A SIZE FOR ALL APPLICATIONS. SINGLE OR MULTIPLE UNITS FOR YOUR INDIVIDUAL JOB.





1 INFINITELY VARIABLE RANGE OF COIL SIZES
a. All sizes wire from same capstan.
b. Current models with coil ranges 16″ to 26″ and 24″ to 36″ without changing blocks.
c. Coil sizes may be altered without stopping.

2 GREATER COIL WEIGHTS
a. Turn tables accommodate coils, drum paks and stems (200 to 1200 lbs.)
b. Oversize loads on handling pallets (1000 to 4000 lbs.)

3 INCREASED RANGE OF WIRE AND ROD SIZES
a. Precise cast control of fine wire to coarse rod.
b. No axial twist.

4 ACCUMULATOR HEAD PROVIDES INTERVAL FOR STRIPPING AT OPERATOR CONVENIENCE
a. Accumulator operating in conjunction with main take-up block is key to uninterrupted constant speed take-up.
b. Operator has 5 to 10 minutes accumulation time for stripping finished package from turn table.

For information concerning your application, please write or telephone.

This equipment manufactured under one of the following U. S. Patents 2,732,060; 2,868,474; 2,844,416; 2,868,268 or others pending.

Barron & Crowther Ltd., Eastleigh, Hants, England. European Draw-Pak Licensee
Idos Industries Ltd., Royston, Herts, England, Sales Agents.

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"America's Finest Wire Draw"

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Made by

Standard Industrial

COMPOUNDS CO., INC.

Member WAS

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(A suburban Chicago area city)

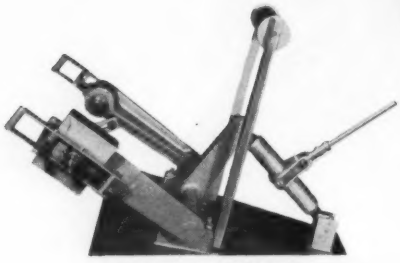
Telephones: 2131 - 2141

"Look to Standard for the Future"

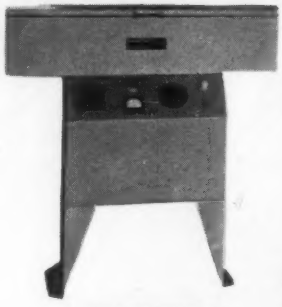
FOR MAXIMUM QUALITY PRODUCTION

THE DAVIS ELECTRIC AUTOMATIC COMBINATION EQUIPMENT

WITH INDEXING HEAD, FAULT DETECTION, MEASURING, COILING, RESPOOLING

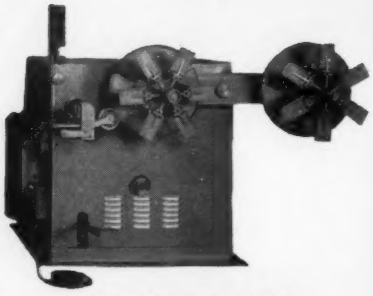


SHAFTLESS PAYOFF



SPARK TESTER

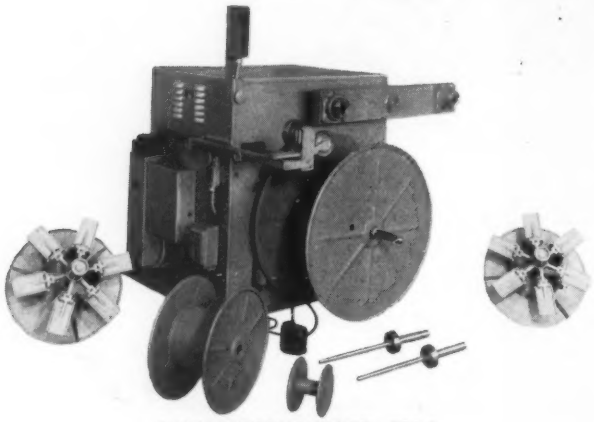
MEASURING MACHINE



RE-SPOOLER & COILER WITH INDEXING HEAD

This new DAVIS ELECTRIC Re-Spooler line from the new DAVIS ELECTRIC Shaftless Pay-off, to the Combination Re-Reeler, Re-Spooler with Indexing Head—insures maximum production for the Electric Wire and Cable Industry in either their Coiling or Re-Spooling applications.

CAN BE PURCHASED AS INDIVIDUAL UNITS OR AS A COMPLETE LINE



DAVIS ELECTRIC MODEL CRS-1

for faster, more uniform wire production

EXCLUSIVE DESIGN FEATURES

1. Indexing head on top has interchangeable shaft feature to accommodate 5/8" up to 1 1/4" shafts or to your specifications. 2 Davis Collapsible Coiling heads can also be used. Reel sizes on indexing head up to 27" diameter.

2. Maximum production can be accomplished with indexing head—when spooling wire on reel or collapsing head operator can be packaging the reel or coil just finished.

3. Lower shaft will take reels up to 30" diameter, also has interchangeable shaft feature for 1 1/4" or 1 1/2" diameter shafts or to your specifications.

4. Infinitely adjustable speed, adjustable width traverse synchronized with spooling speed for reels up to 16" traverse.

5. Electronic speed control with 10 to 1 range for wire speeds up to 1200 feet per minute, or higher if specified.

6. Adjustable Time Acceleration starts machine with low torque factor to avoid stretching and/or breaking of wire.

7. Electric disc brake for quick stopping of both upper and lower shafts.

8. External Tachgenerator can be supplied if desired for constant wire speed.

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DAVIS ELECTRIC CO.

WALLINGFORD, CONNECTICUT

DUAL and SINGLE TAKE-UPS • PAY-OFFS • CAPSTANS
SPARK TESTERS • RE-SPOOLERS
RAM-TYPE TEFLON EXTRUDERS

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FOR WIRE AND CABLE COATING

In addition to Vygen 120 PVC resin, there are *three* specially-formulated Vygen compounds completely tested and UL-approved for specific wire and cable applications. Available in quantities to fit your needs, each Vygen compound and resin is composed of the very finest raw materials, processed in the most modern facilities. Each is designed to do its job better, *and* to save you money. Send for generous samples, literature and technical assistance.

VYGEN 6812 COMPOUND

UL-approved for UF-NMC cable, Type T, TW, 60°C, Oil, and 80°C appliance wire applications. May also be used as primary insulation for other cable constructions and jacketing.

VYGEN 6035 COMPOUND

UL-approved for Type T, TW, and exposure to oil use at 60°C. This compound combines excellent physical and electrical properties with very good weather and flame resistance.

VYGEN 9221 COMPOUND

Meets UL requirements for 90 and 105°C applications. Recommended for appliance, radio hook-up, machinery wire etc. where heat resistance and good physical properties are required.

VYGEN 120 RESIN

UL-approved as interchangeable with other PVC resins used as wire insulating material. For fast dry-blend extruding with monomeric or polymeric plasticizers—assures lack of gelled particles, excellent heat and light stability and long life.

TYPICAL ANALYSIS

Form	White Powder
Intrinsic Viscosity	1.18
Specific Gravity	1.40
Bulk Density, gm/cc	0.52
lbs/ft³	32.5
Volatiles	0.2

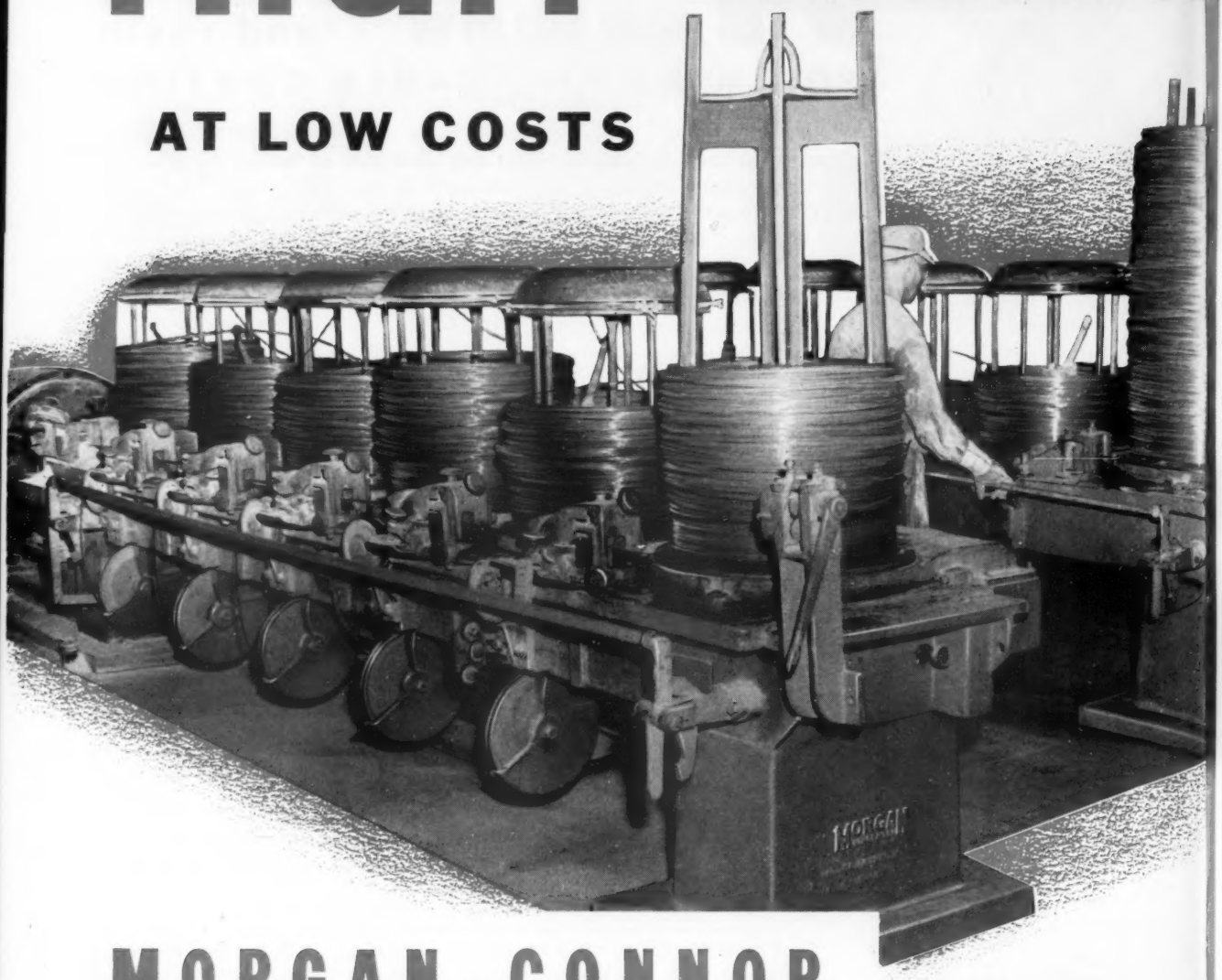
Creating Progress Through Chemistry

PHYSICAL PROPERTIES OF MOLDED SPECIMENS

	6812	6035	9221
Specific Gravity at 25°C/4°C	1.32	1.33	1.38
Tensile, psi at 25°C	2550	2950	3100
Modulus at 100% Elongation, psi	1450	1780	2150
Elongation, % at 25°C	320	315	340
Hardness, Shore A, inst at 25°C 10 sec at 25°C	90 82	94 86	97 92
Brittle Point, at – 15°C	Passes	Passes	Passes
Volume Resistivity, ohm-cm at 25°C and 50% R. H.	3.1×10^{14}	2.8×10^{14}	3.5×10^{13}

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

HIGH PRODUCTION PERFORMANCE AT LOW COSTS



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Obtain increased production efficiency with heavyweight bundles. Morgan machines will give you maximum weight bundles at the lowest possible cost.

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WM-112

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Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 34 May, 1959 No. 5

Designated as Official Publication By The Wire Association

Contents

The Wire Outlook 571

Measurements of Temperature in Wire Drawing with a Wire Drawing Die Thermocouple Using a Hard Metal Ball Core by Rudolph Bruhl 573

Electrical Resistance Characteristics of Polyvinyl Chloride Formulations by Mansfield Williams and J. R. Taylor 577

Capacity Measurement—A Method for Wire Mills by Carlisle Burns 582

Continental Steel's New Nail Mill 590

Thermal Stress-Cracking of Polyethylene II by J. H. Heiss, V. L. Lanza and W. M. Martin 592

From Log to Finished Reel by Henry Carris 594

Ultrasonic Cleaning of Fine Wire Drawing Dies by John W. Cowan 595

Wire Kinks ..... 599 and 601

The Wire Association West Coast Regional Meeting 600

Outstanding Personalities of the Wire Industry 611

Steel Statistics 618

Copper Statistics 619

A Review of Recent Wire Patents 621

Index to Advertisers 639

Where-To-Buy 640-644

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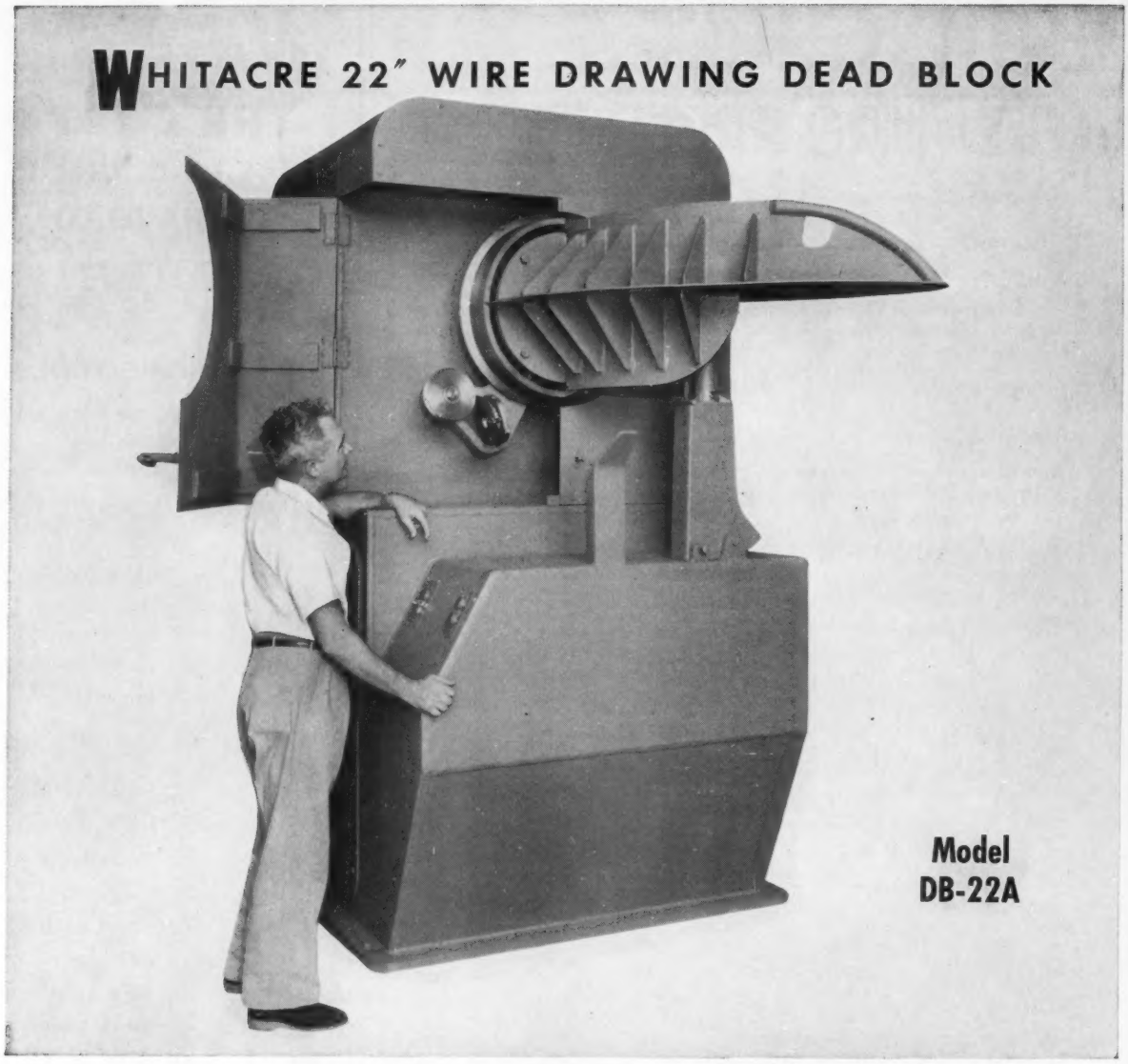

Model DB-22A

Continuous Production—Efficiency Approaching 100%

Gives you these advantages

Continuous increased production achieved by: • No down time for stripping • Permits packaging into stationary container or uninterrupted palletizing on stems • No tangling nor snarling from handling • Design simplicity. No back-gearing nor similar mechanisms • Greatly reduced floor space requirements • Dies in supplying drawing machine can be changed without stopping dead block • Accumulation type machines can be "run down" without stopping dead block • Continuous inspection and sampling • Breaks welded in production — low scrap loss • Increased production with lessened operator fatigue • Maintenance eliminated except for occasional lubrication of four main bearings and two motor bearings • Dead block can be located anywhere with wire literally piped from wire drawing machine • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

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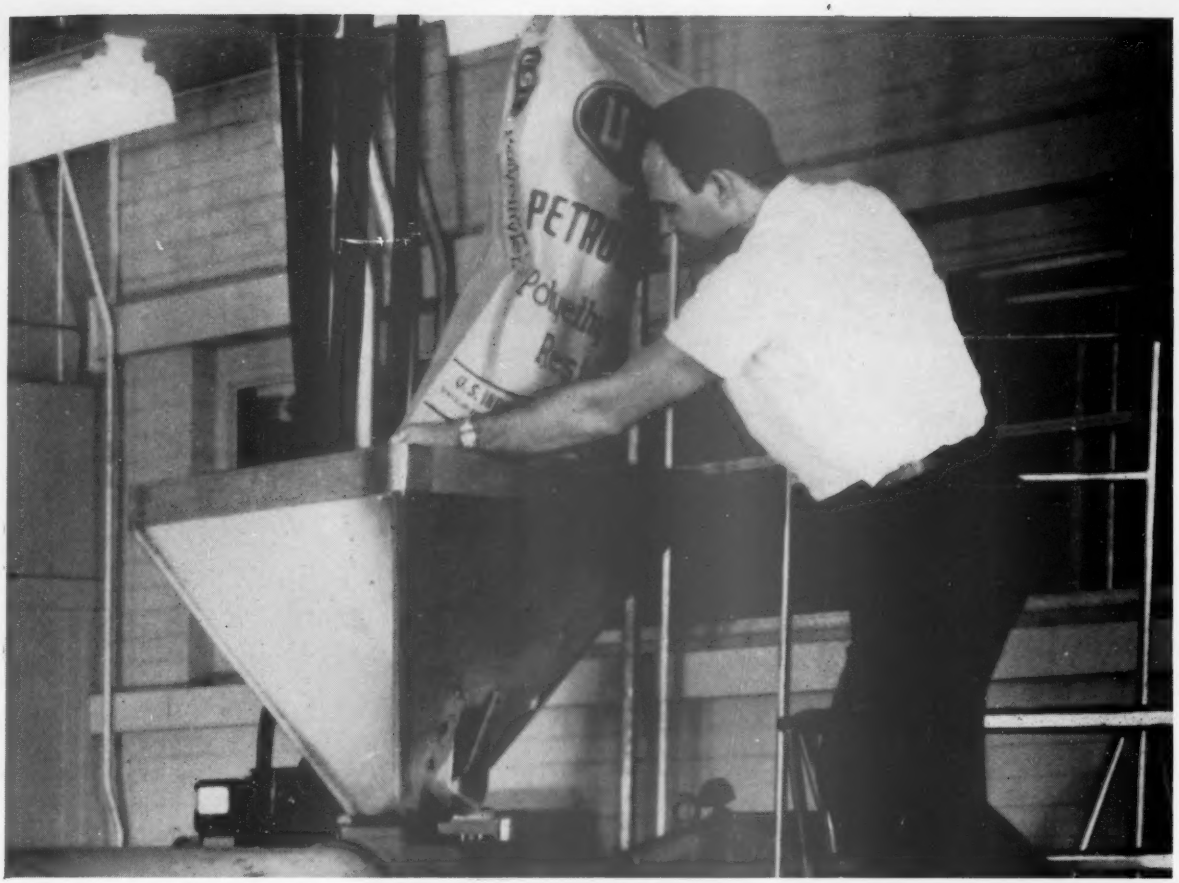

You charge the resin as received when you produce polyethylene-covered wire

because polyethylene needs no blending

Manufacturing polyethylene-covered line wire is simple. You feed the resin, as you receive it, to the extruder. There are no plasticizers, softeners, antioxidants to add. There's no prebatching, blending, milling; no vulcanizing after extrusion. Carbon black and antioxidants are already in the resin.

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With polyethylene, you base production on a material that has trended downward in price as capacity increased. And ample capacity for PETROTHENE® polyethylene insures continuous supplies of uniformly high-quality resin.

Look To Tomorrow's Sales

See how polyethylene can improve the profitability of your operations tomorrow, if not today. With other insulating costs trending upward, polyethylene can be expected to be your most profitable line wire coating in the years to come. You can prepare for those profits *by promoting polyethylene-covered line wire now*, just as U.S.I. is doing in a series of advertisements in utility magazines.

For your customers, polyethylene means a product that is easy to handle . . . has exceptional weather and stress-crack resistance . . . is long-lasting in service. This tough plastic covering is registering outstanding service records for power cable, communications cable, WD-1 infantry field wire, TV lead wire and many other applications.

U.S.I. PETROTHENE polyethylene resins are tailored to provide the proper balance of properties needed in different end uses. To help you choose the most suitable resin for each use, we've compiled a chart of the properties, applications and applicable specifications of PETROTHENE polyethylene compounds. This information is in a new four-page data sheet, "PETROTHENE Resins for the Wire and Cable Industry." Also available is U.S.I.'s comprehensive 100-page "PETROTHENE Polyethylene . . . A Processing Guide." Write for your copies.

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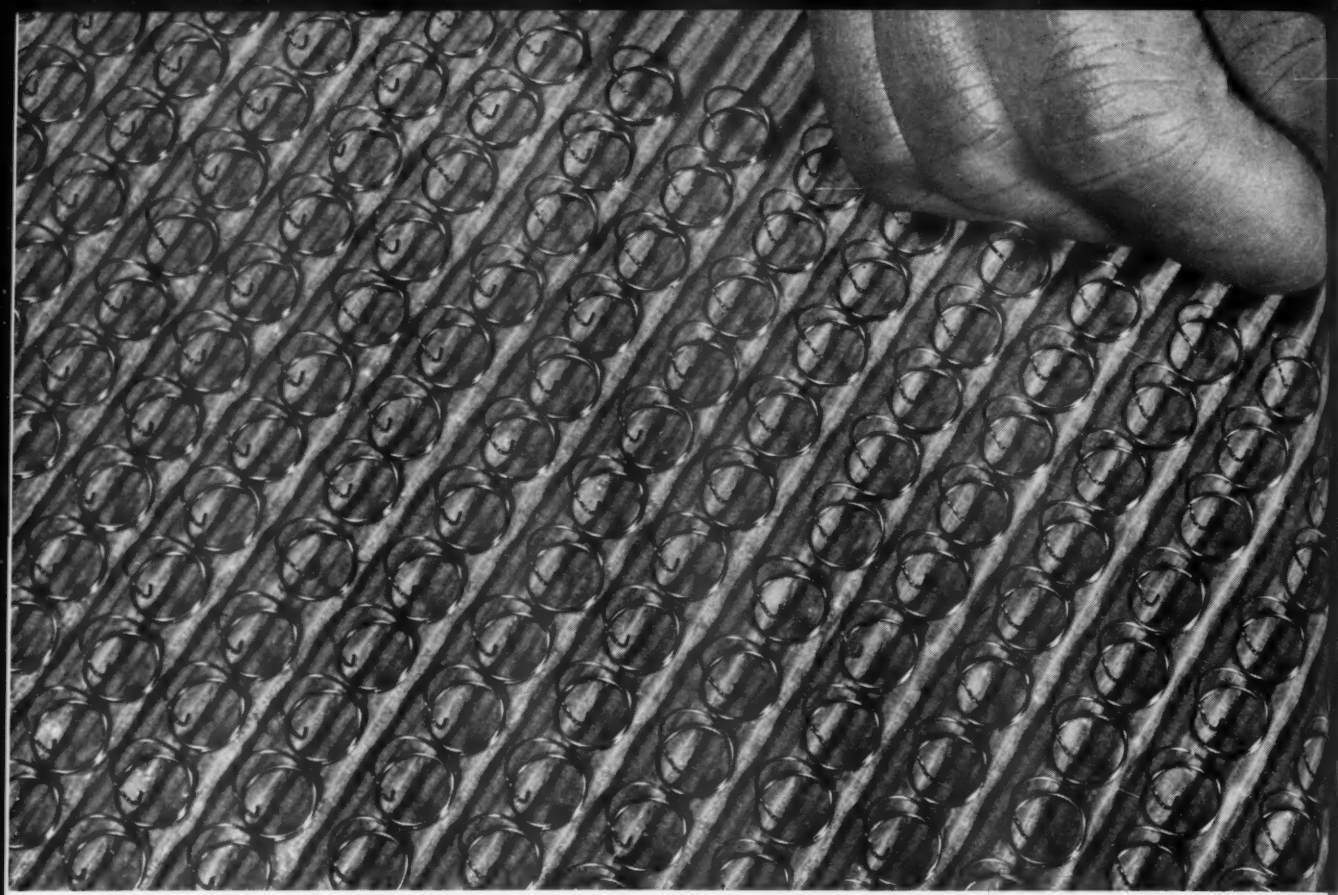


Wispy but precise as the pattern they make on this gummed pallet are carburetor pump springs coiled from Johnson Steel's .014 tin-coated music wire.

Johnson Steel's Wire Is In Springs That Are . . .

'Out Of This World'

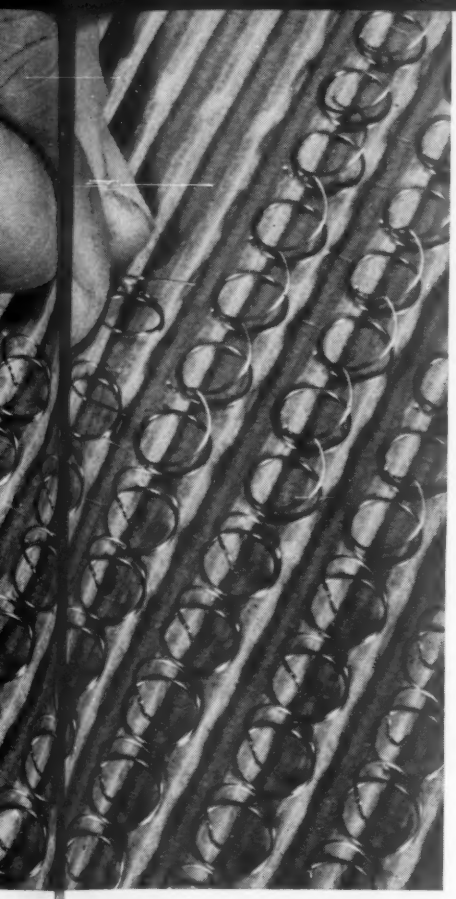
Mid-West Spring relies on Johnson Steel's Music Wire to make precise springs for satellites to sewing machines.

Trouble is their business . . . customers' trouble, that is—even in Outer Space.

That's the approach of Mid-West Spring Manufacturing Co. of Chicago, a firm that goes after the tough jobs with the help of Johnson Steel & Wire Co., its major supplier.

"We want the job the others can't do, whether it's a spring for a space missile or for a thermostat in your home," says R. H. Muehlhausen, vice president of sales.

Full range of Johnson Steel's specialty wires stocked at this warehouse guarantees same-day delivery to wire users in Chicago area.



Tooling, production skill, close control of quality and reliance on Johnson Steel's music wire for 31 years enable Mid-West to take difficult jobs in stride.

"Johnson Steel is the only manufacturer who can provide us with a full range of music wire, plus oil tempered and variously coated as well as bright, hard drawn spring wires we require," says James J. Dunne, purchasing agent and assistant sales manager. "The large stock in their Chicago warehouse is a distinct advantage, especially when we are pressed for fast delivery."

Mid-West is a leading producer of precision-engineered springs—some of them literally "out of this world," performing functions in missiles and satellites now in orbit. Other products of the firm's three plants are used in farm implements, business machines, furnace controls, autos, home appliances and various electronic devices.

Mid-West uses the full range of Johnson Steel's music wire, from .003 to .300 inch, in all finishes. Every coil is checked first with a pilot spring, next at set-up on the coiler and finally at random in production. Some special springs get 100 percent electronic testing.

Roland Parduhn, Mid-West's methods engineer, says:

"We watch tensile strength, surface condition and size very closely. Any deviation or defect, and too many springs would vary from their designed load. We depend on Johnson Steel to maintain consistent quality."

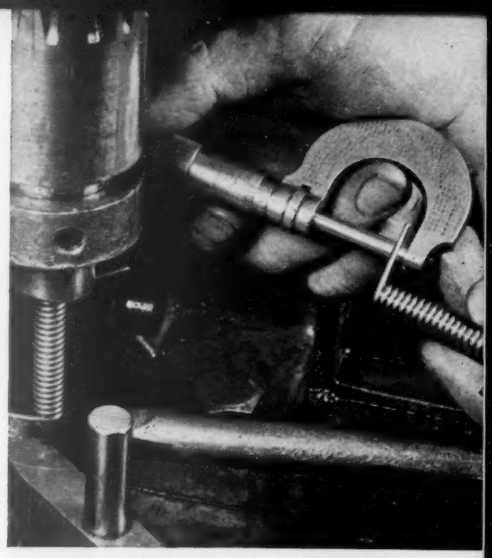
This applies especially to one of the company's biggest production run items—a tension spring for the Anderson Co. of Gary, Ind., supplier of ANCO windshield wiper blades and arms to the automobile, truck, bus and aircraft industries.

• **Coils for Precise Control**—The spring precisely controls the pressure of the wiper on the glass. Too much pressure and the wiper will stall; too little and it will flutter in the wind.

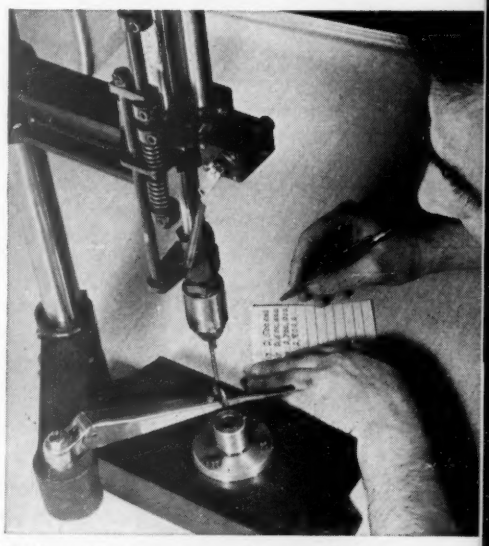
Mid-West's production of this spring—numbering in the millions—represents a rugged performance test, but Johnson Steel's music wire is its match.

The help that Johnson Steel gives Mid-West Spring in its production processes can be duplicated for your advantage. Whether your need is music wire, or any of the many other products in Johnson's complete line of specialty wires, the benefits start the moment your order is received.

A national sales staff is ready to help you quickly and profitably with any application. Contact the district office nearest you.



Unvarying size, tensile and surface of Johnson Steel's .084 music wire meets Mid-West Spring's demands for coiling this windshield wiper spring.



Fatigue test measures endurance of wiper spring. Here spring records its 2,800,000th stroke with no sign of load loss.

Coilability counts in making this thermostat control spring, which is tested and sorted electronically on coiler. Adjustable-screw plug is threaded in spring, made of Johnson's .058 music wire.

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Worcester 1, Massachusetts

a subsidiary of **Pittsburgh Steel Company**

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Specialists in wire and cable applications, Cary offers for your consideration:

BLACAR #250 Resin

UL approved—completely interchangeable in recognized compounds. Precisely controlled high molecular weight—low gel count, excellent dry blending and extrusion features, ensures superior processing qualities. (Low and intermediate weight resins also available).

BLACAR COMPOUNDS (All UL approved)

#2600—An economical vinyl compound with primary applications for type T-ACT-TF-TFF wire and cable, and non-metallic inners.

#2700—General purpose vinyl compound for wide range of low-tension applications (specifically T-TW-TFF low cost building wire), including oil exposure at 60°C.

#2800—High quality vinyl compound with maximum versatility as primary insulating material. Excellent processing features electrical properties and extrusion rates—plus smooth, glossy finish. Ideal for 80°C. appliance wire and UF-NMC jackets and inners.

IF YOUR NEEDS ARE SPECIAL — Cary can modify existing products or custom-formulate to the most exacting requirements.

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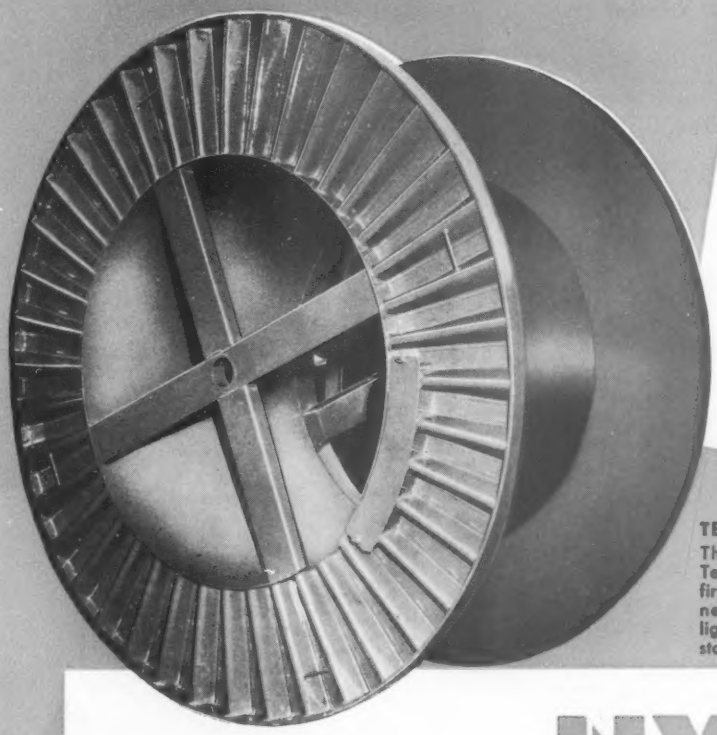

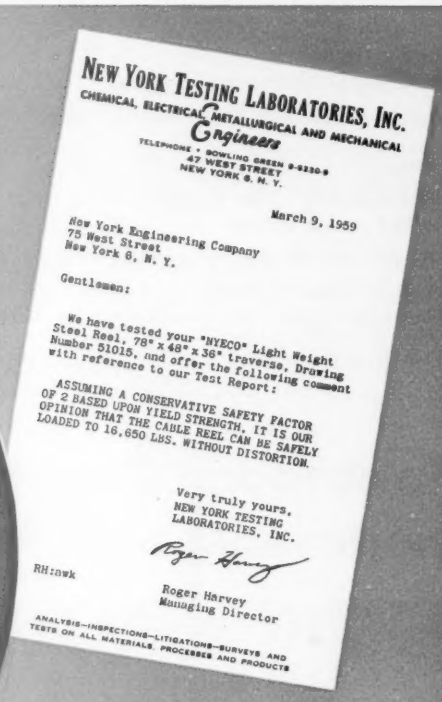

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March 9, 1959

New York Engineering Company
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Gentlemen:

We have tested your "NYECO" Light Weight Steel Reel, 78" x 48" x 36" traverse, Drawing Number 51015, and offer the following comment with reference to our Test Report:

ASSUMING A CONSERVATIVE SAFETY FACTOR OF 2 BASED UPON YIELD STRENGTH, IT IS OUR OPINION THAT THE CABLE REEL CAN BE SAFELY LOADED TO 16,650 LBS. WITHOUT DISTORTION.

Very truly yours,
NEW YORK TESTING LABORATORIES, INC.

RH:awk

Roger Harvey
Managing Director

ANALYSIS—INSPECTIONS—LITIGATIONS—SURVEYS AND TESTS ON ALL MATERIALS, PROCESSES AND PRODUCTS

TESTED AND APPROVED!
This letter from New York Testing Laboratories, Inc. confirms the superiority of the new NYECO smooth-faced, light weight steel reel over standard reels.

ANNOUNCING THE NEW NYECO SMOOTH-FACED LIGHT WEIGHT STEEL REEL

NOW AVAILABLE FROM NYECO...

greater protection against damage in shipping and processing with this rugged, weather-resistant, warp-proof, NYECO Steel Shipping Reel. All reels are furnished with four cross-arms unless otherwise specified. Drive-holes optional. No die charges or extras...any drum diameters or traverse. Flange diameters 42" to 90" inclusive.

NYECO ALSO MANUFACTURES

- Impregnating Tanks
- Vulcanizers
- Floor Rolls
- Pressure Vessels

YOUR INQUIRIES WILL RECEIVE OUR PROMPT ATTENTION

Send specifications for STEEL SHIPPING REELS, IMPREGNATING REELS, PROCESSING REELS, SUBMARINE CABLE REELS AND BRIDGE REELS. Prompt deliveries on large or small orders.

ANY QUANTITY—ANY SIZE—
ANY LOAD FLANGE DIAMETER
from 42" up

Specialists to the wire industries for over 50 years.

NYECO

NEW YORK ENGINEERING COMPANY

75 WEST STREET • NEW YORK 6, N. Y.

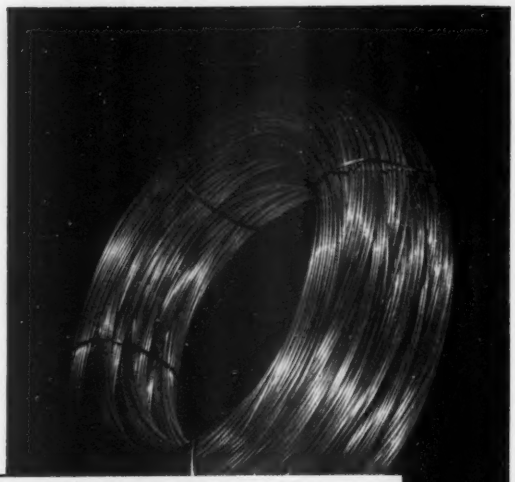
TELEPHONE: WHitehall 4-5380 • CABLE: NYECO, N. Y. • PLANTS: YONKERS, N. Y.

"Tough-to-make"

Cold-Headed Products like these . . .

- Tubular Rivets (Punch Extruded).
- Non-threaded, multi-diameter, head and shoulder parts, drilled or not drilled.
- Washer and binding head screws with rolled threads.
- Special design fastenings and other small parts of intricate shape, with or without requirements for drilling or threading.

. . . become "routine" with



SCOVILL EXTRUDED Cold-heading WIRE

(Cartridge Brass, 70%)

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

IT ELIMINATES

1. OUT-OF-ROUND HEADS
2. INCOMPLETE FILLING-OUT OF HEADS AND SHOULDERS
3. ROUGH "ORANGE PEEL" EFFECT
4. UNSOUND HEADED PARTS
5. RED STREAKS AND STAINS
6. NON-UNIFORM FLOW

SCOVILL

Send for new folder.

Scovill Cold-Heading Wire is extruded from CONTINUOUS-CAST brass billets by the hot extrusion process, then cold-drawn and annealed in accordance with closely controlled mill procedures.

CONTINUOUS CASTING produces *more uniform metal* than any other process, both in chemical composition and in freedom from casting flaws or other variations.

Scovill has standardized on *Cartridge Brass,* 70% for wire to be used in cold-heading operations. This alloy has a 5% HIGHER COPPER CONTENT than is generally found in brass cold-heading wire and is more ductile.

Prove this on your next wire order. Let us help you specify the proper closely controlled Scovill temper to produce more nearly perfect headed brass parts . . . whether you require "flow" characteristics for heading, or "flow" plus essential rigidity for secondary machining.

SCOVILL MANUFACTURING COMPANY, Mill Products Division

99 Mill Street, Waterbury 20, Connecticut. Phone PLaza 4-1171.

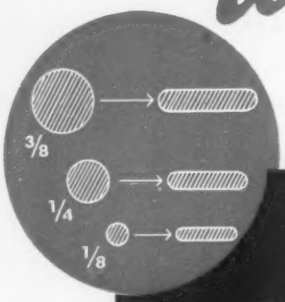
125C58

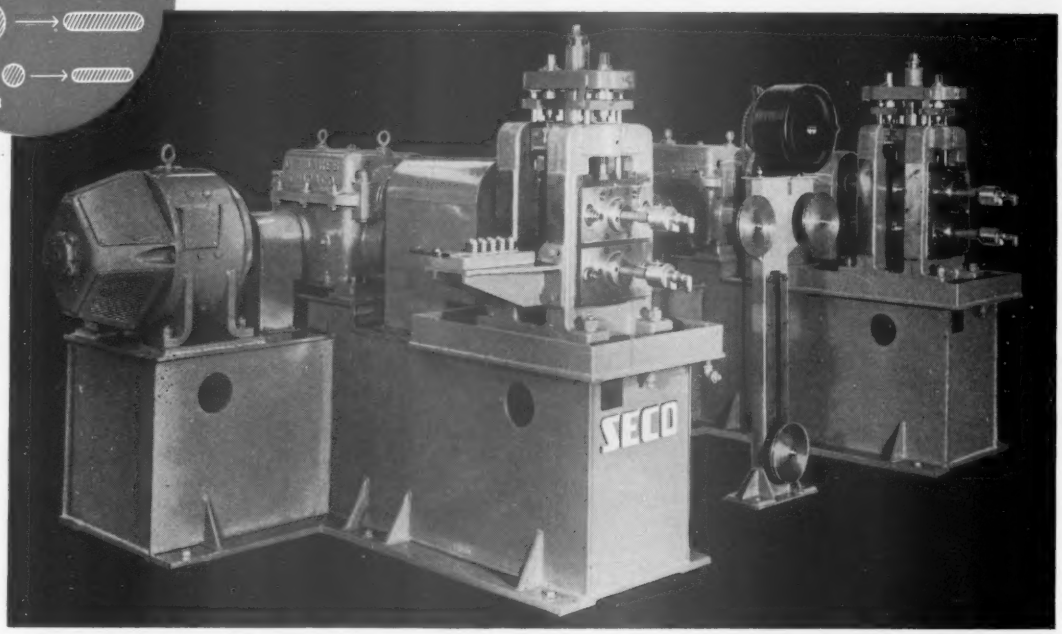
SECO

When You See SECO
You're Seeing the Best!

Wire FLATTENING MILLS

Meet Today's High Standards of Quality and Efficient Operation





Shown above is the SECO 6" Tandem Mill with carboloy rolls and Timken Tapered Roller Bearings. Speed range is from 200 to 800 fpm. The mills are driven by DC motors through combination worm-helical reducers with universal joints, for silent and vibrationless operation. 8" and 10" mills of the same design and construction are also available. Suitable traverse reels are furnished.

Call or write for information and complete data. Consultation invited — no obligation.

STEEL EQUIPMENT COMPANY
P. O. BOX 737, WARRENSVILLE STATION
CLEVELAND 22, OHIO

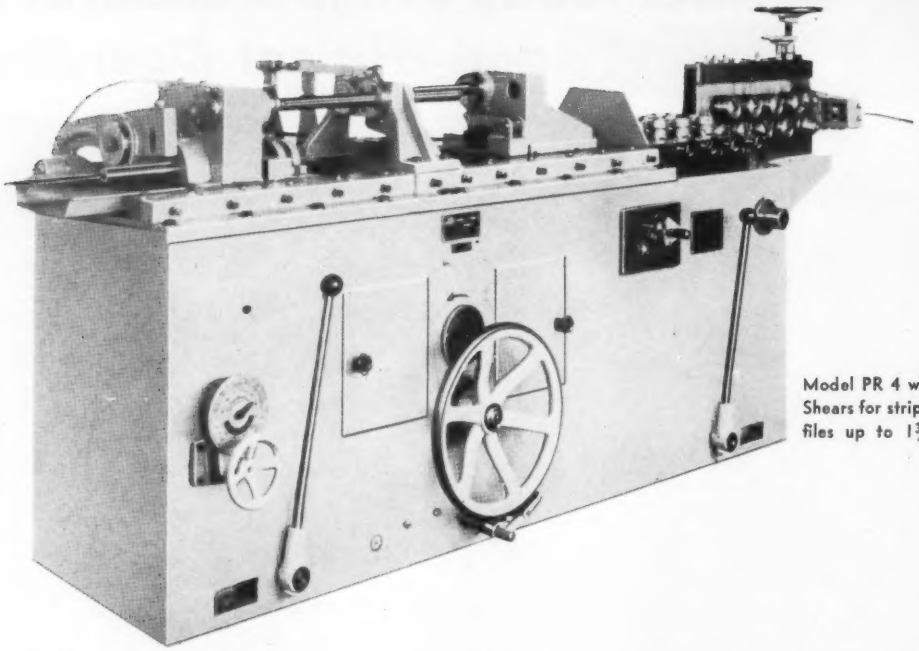
SECO

pan american

presents

the world's most advanced

STRAIGHTENING AND CUTTING MACHINES



Model PR 4 with Flying Shears for strip and profiles up to 1¾" width

A complete line of Automatic Straightening and Cutting Machines manufactured by the Koch Co. in Western Germany for Wire, Bars, Rods, Profiles, etc.

ALSO DESIGNERS AND BUILDERS OF AUTOMATIC MACHINERY FOR YOUR SPECIAL REQUIREMENTS

SALES OFFICE FOR USA AND CANADA:

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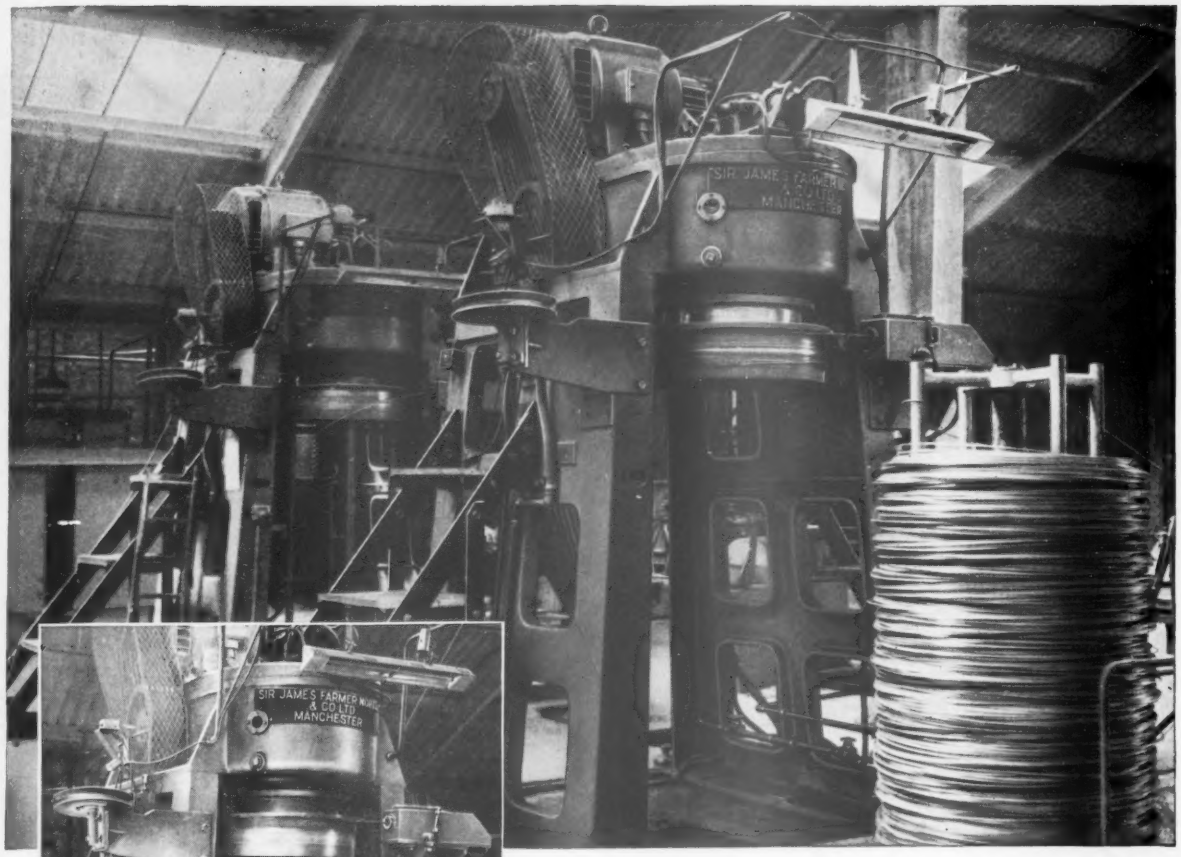
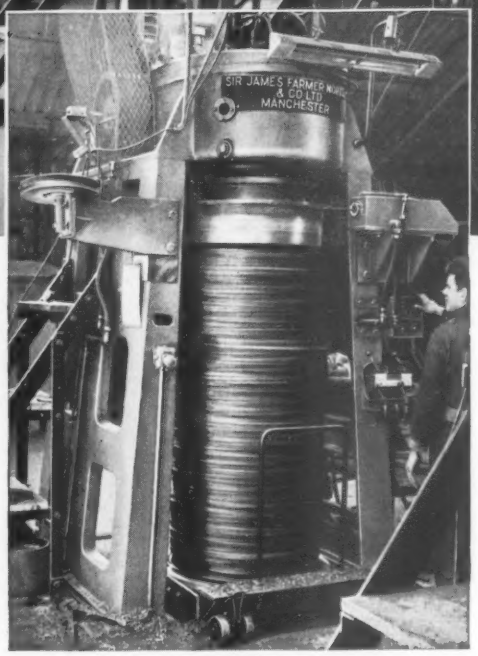
Farmer Norton





Photographs by courtesy of G.K.N. Reinforcements Ltd.

The above shows a double draft Gravity block drawing ton coils of steel wire for the manufacture of reinforced concrete fabric. This machine is capable of drawing all sizes from ½" rod down to 12 s.w.g. in double or single drafts.

THIS SYSTEM ENSURES

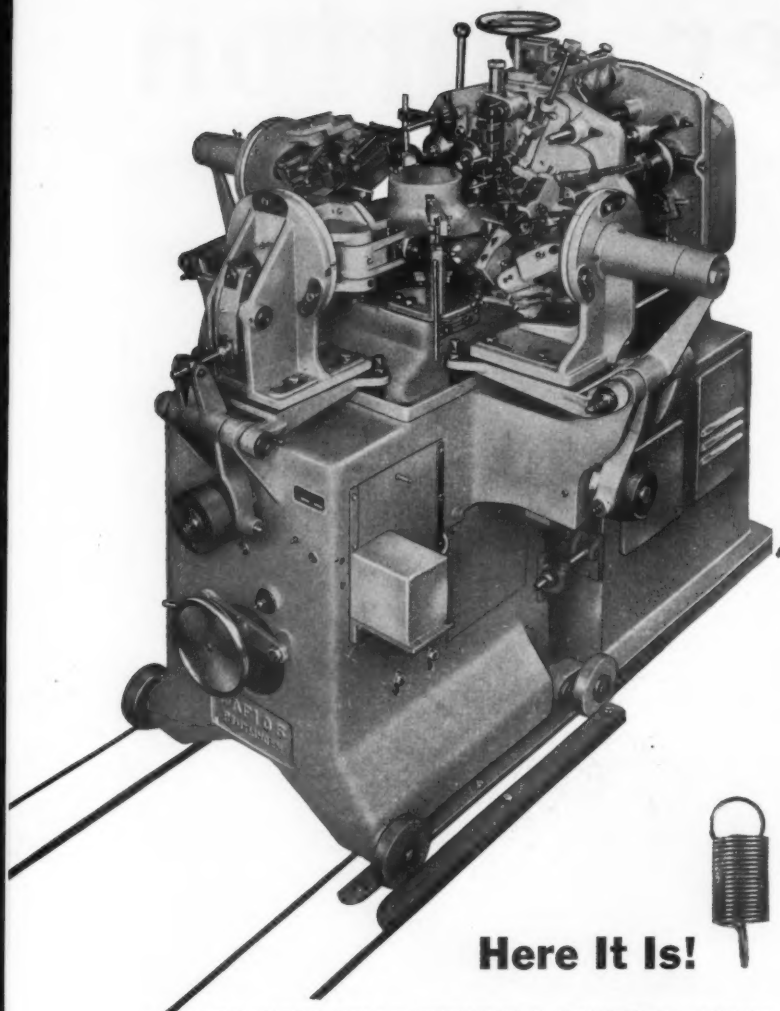
- ★ high machine efficiency
- ★ reduction in handling times and ease of handling after drawing
- ★ long runs on the fabric making machines, which obviate machine stoppages for welding and changing swifts

Makers of all classes of Wire Drawing Machinery and pioneers of the inverted block system for handling large coil weights.

Sir James Farmer Norton & CO. LTD.

ADELPHI STREET • SALFORD • LANCASHIRE • ENGLAND

Sole Representative in U.S.A.: Steel & Wire Machine Co., 15457 Euclid Ave., Cleveland 12, Ohio. MUlberry 1-7151



AUTOMATIC SPRING COILING LOOPING MACHINE

Here It Is!

THE FIRST FULLY AUTOMATIC UNIVERSAL SPRING COILING AND LOOPING MACHINE

for the production of extension springs looped on both ends. The loops can be made parallel or at any angle to each other. The uniformity of placement of loops and length of springs far surpasses results achieved by "old fashioned" methods.

It is not only possible to produce springs with normal loops, half open loops or machine loops, but, also springs having two different styles of loops.

THE ZO SERIES OF COILER-LOOPERS ARE AVAILABLE IN 2 MODELS:

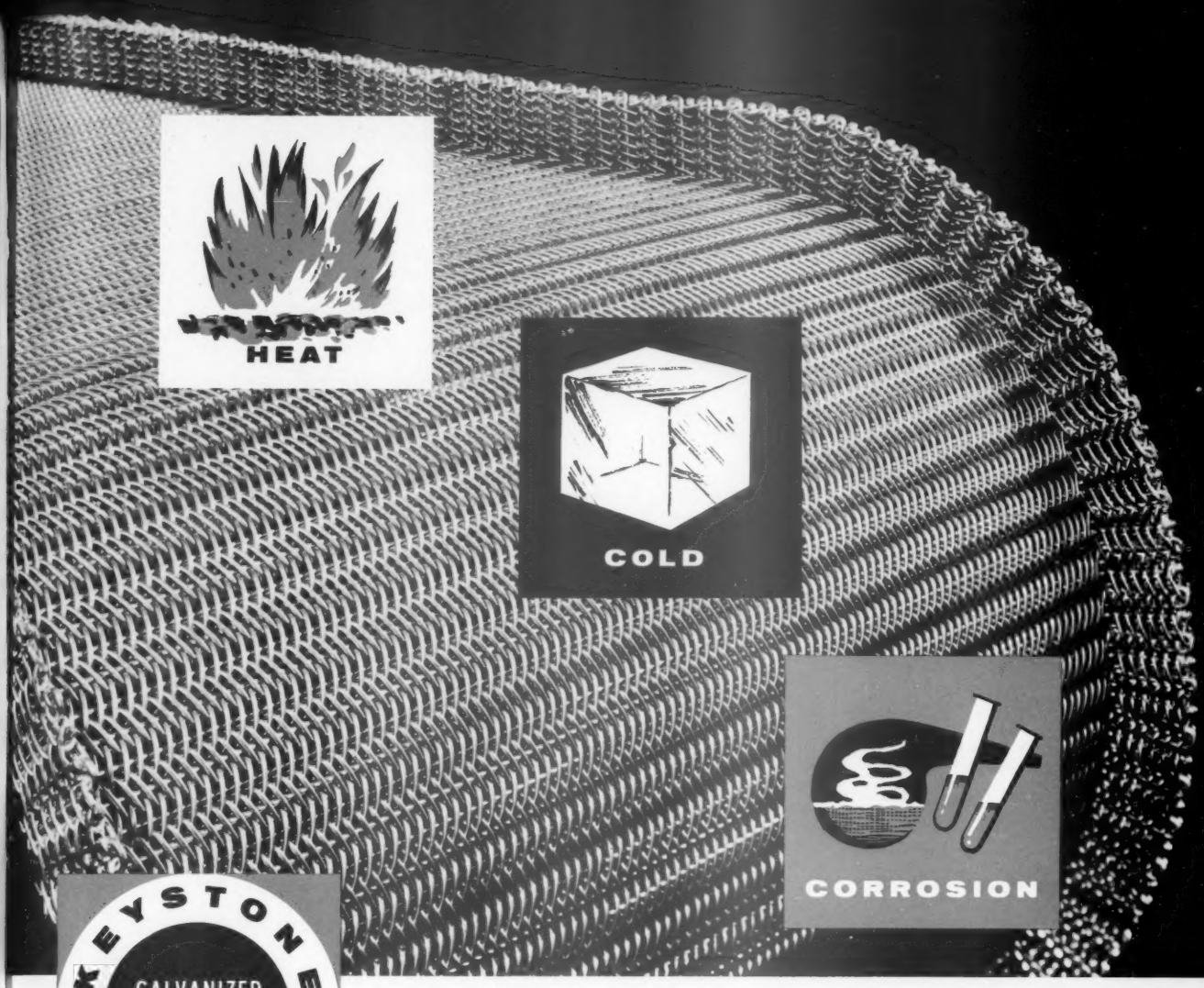
	Model ZO/15	Model ZO/30
Wire diameters	.0197" to .0475"	.0394" to .118"
Lengths of Springs	.750" to 5½"	1¾" to 7"
O. D. of Springs	.200" to ⅝"	.394" to 1"

Production on both Models up to 40 complete springs per minute.

WAFIOS

U. S. Office: WAFIOS MACHINERY CORPORATIO
61 Hudson Street, Hackensack, New Jersey

WAFIOS MASCHINENFABRIK REUTLINGEN/GERM



KEYSTONE GALVANIZED INDUSTRIAL WIRE WIRE STUDY

ALLOY WIRE BELT COMPANY solves these problems with KEYSTONE WIRE

What kind of wire is required to manufacture wire belts that can function perfectly in conditions ranging from minus 40° to plus 1140° Fahrenheit, that can be crimped to a 180° angle at high speed—and resist severe corrosion and abrasion?

Alloy Wire Belt Company, San Jose, California, has the answer: Keystone Galvanized Industrial Wire! They've found it resistant to corrosion, with uniform grain structure and the right specified tensile strength for precision high speed forming. Zinc coating is absolutely uniform and resists flaking.

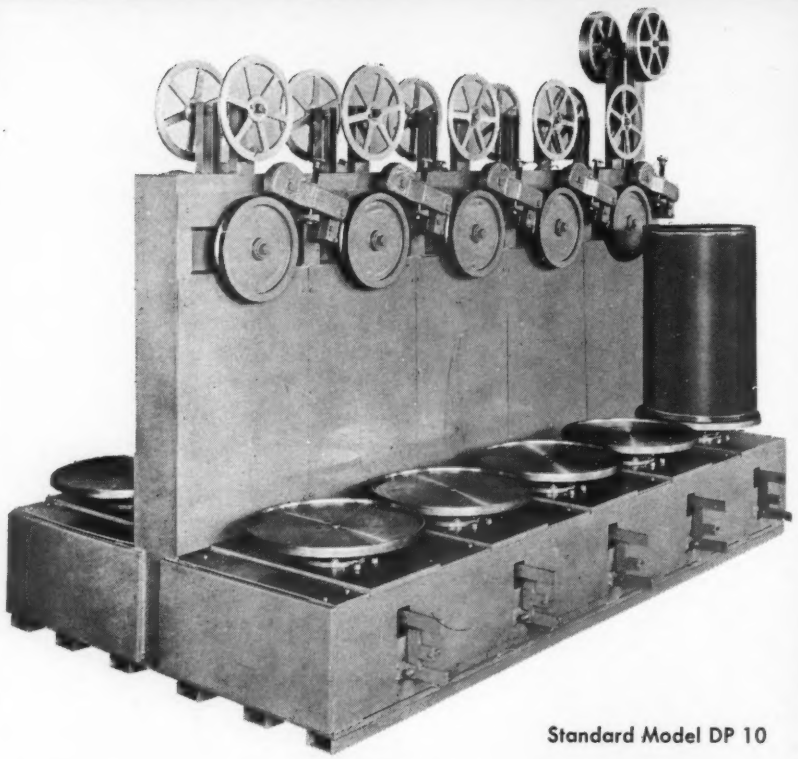
Keystone and Alloy Wire Belt worked together in developing the right wire for their needs. Confidential counseling and metallurgical assistance will be yours for the asking, too. Call your Keystone man today!

Keystone Steel & Wire Company, Peoria 7, Illinois

KEYSTONE WIRE FOR INDUSTRY

COOK'S *universal* DRUM PACKER

gives you fast, dependable, continuous wire packing!



Standard Model DP 10

Individual clutch control units offer greater flexibility of operation. Enameling, tinning, galvanizing, patenting and other applications. Combination takeup unit permits wire packaging of coils from B&S gauge #6 (.162) to #24 (.0201) dia. or from 100 lb. capacity pails to 1000 lb. drums measuring up to 30" high and 20" or 22" dia. Infinite, variable speed control gives you the specific speed desired for each wire size, ranging from 20 to 120 ft. per minute. Packaging set-ups are optional, from spindle to spindle, without altering the machine which mounts 5 wires each side. Our complete line handles wire sizes from .0130" to .162" dia. If your needs are different from those above, your inquiry (specifying the application which interests you) will receive immediate attention from

COOK *Manufacturing Company*

50 E. 25th ST., PATERSON 4, N. J., ARmory 4-6380

Wire and cable processing and fabricating machines

Canadian Agent: E. V. Larson Co., Ltd., Toronto • European Agents: Knoerzer & Co., Stuttgart, Germany and Capamadjian LeMonnier Cie Ltd., Paris, France

Discover a new difference —
- in die life
- in brightness

FLEXAL S

A New Metal Processing Lubricant by SWIFT & COMPANY

Flexal "S" is a distinct and exclusive new lubricant that is available only through Swift & Company. It is an extremely high titer, uniform fine powder that is designed to *stay put* on the wire through multiple draws—while lubrication is required. Yet, it is easily dissolved, by hot water washing, from wires which demand a lubricant-free surface.

Flexal "S" is designed for use in either **dry drawing** or **hot dip coating** and has shown excellent results for use in combination of dry and wet draws. It will pay *you to check the specs* on FLEXAL "S". Return the coupon for details—or a trial order.

FOR DRY DRAWING or HOT DIP COATING

- Extremely high titer
- Uniform fine powder
- Water soluble stearate base
- Very low in moisture
- Contains rust inhibitor and bonding aid

To Serve Your Industry Better

Swift 104TH YEAR

JUST CLIP TO YOUR LETTERHEAD AND MAIL

S-43R

SWIFT & COMPANY, INDUSTRIAL SOAP DEPT.
4115 Packers Ave., Chicago 9, Illinois.

☐ How can we place a trial order for Flexal "S" for evaluation in our operations?

☐ Please send a FREE 10 lb. sample of Flexal "S" for our evaluation.

(Please describe intended usage briefly).....

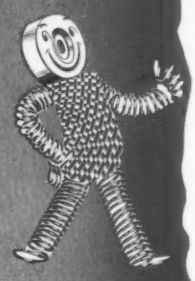
.....

Company.....

Address.....Zone....State.....

City.....

Your Name & Position.....

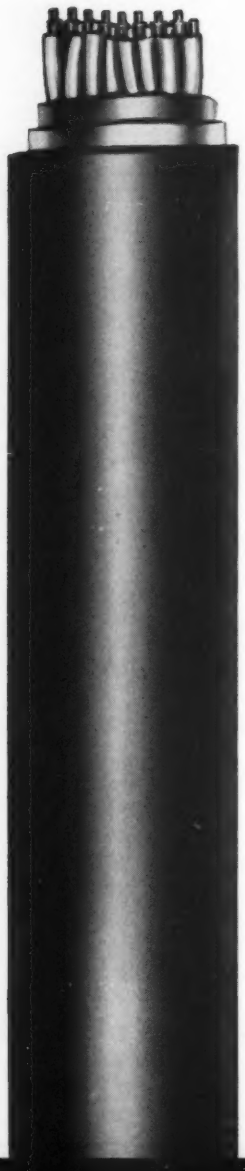


and FREDDIE FLEXAL invites your further inquiry

S-43R

The message is:

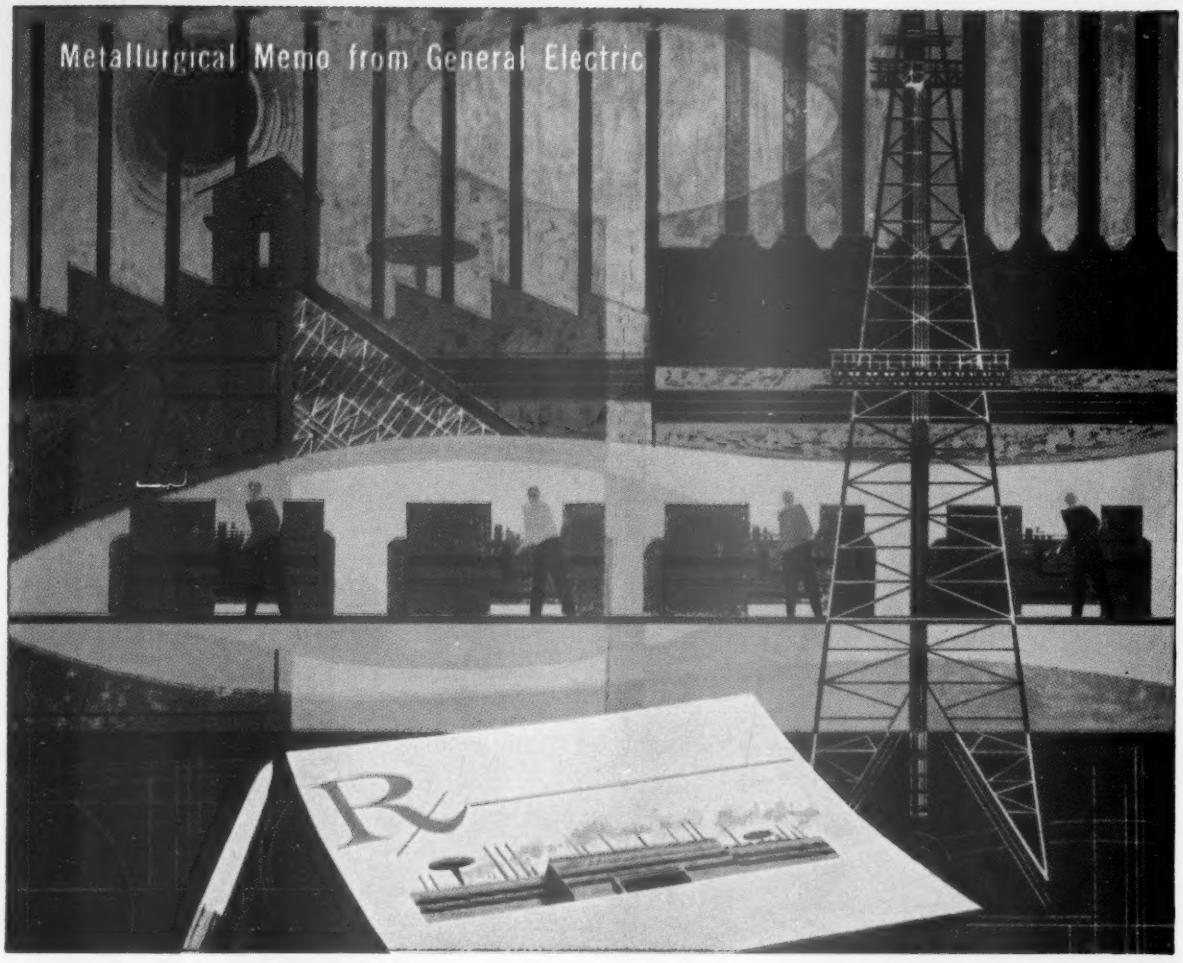
MONSANTO POLYETHYLENE 14202 NOW WESTERN ELECTRIC APPROVED



as high molecular weight black polyethylene telephone cable jacketing material

What does Western Electric approval mean?
It means passing the most exacting tests in the industry. 14202 Black can meet specifications established to assure an estimated cable service life of 30 years or longer! Western Electric tested for stress crack resistance, low gel content (to minimize localized degradation), appearance, extrusion rates, heat stability. And the testing extended over a long period of time to assure uniformity of properties.
Western Electric approval qualifies Monsanto as an additional source of black polyethylene for Bell System telephone cable jacketing applications.
For complete technical data, write to Monsanto Chemical Company, Plastics Division, Room 1258, Springfield 2, Mass.

Monsanto®



Why Industry's "metallic vitamins" now serve you better than ever

Metallurgical Products Department reports on Carboloy® cemented carbides . . . and on the new Authorized Carboloy Die Distributor set-up that gives you faster die delivery and service

The very introduction of Carboloy cemented carbides—up to 50 times longer wearing than steel—reacted like a vitamin on wire production. Carboloy cemented carbide dies have become an industry standard—have helped pave the way for improved wire products.

Now, another forward step has been taken. Carboloy dies are now available in all major die centers from Authorized Carboloy Die Distributors. This progressive step in distribution lets you get *immediate delivery* from complete die stocks carried by each distributor; and he'll give you fast die fabrication and refinishing service, too.

Next time you need dies, it will pay you to call one of the following Authorized Carboloy Die Distributors: Glen Carbide, Pittsburgh 19, Pa.; Allied Carbide, Jamaica 18, N. Y.; Bronson & Bratton, Chicago 32, Ill. Or write: *Metallurgical Products Department of General Electric Company, 11171 E. 8 Mile Blvd., Detroit 32, Michigan.*

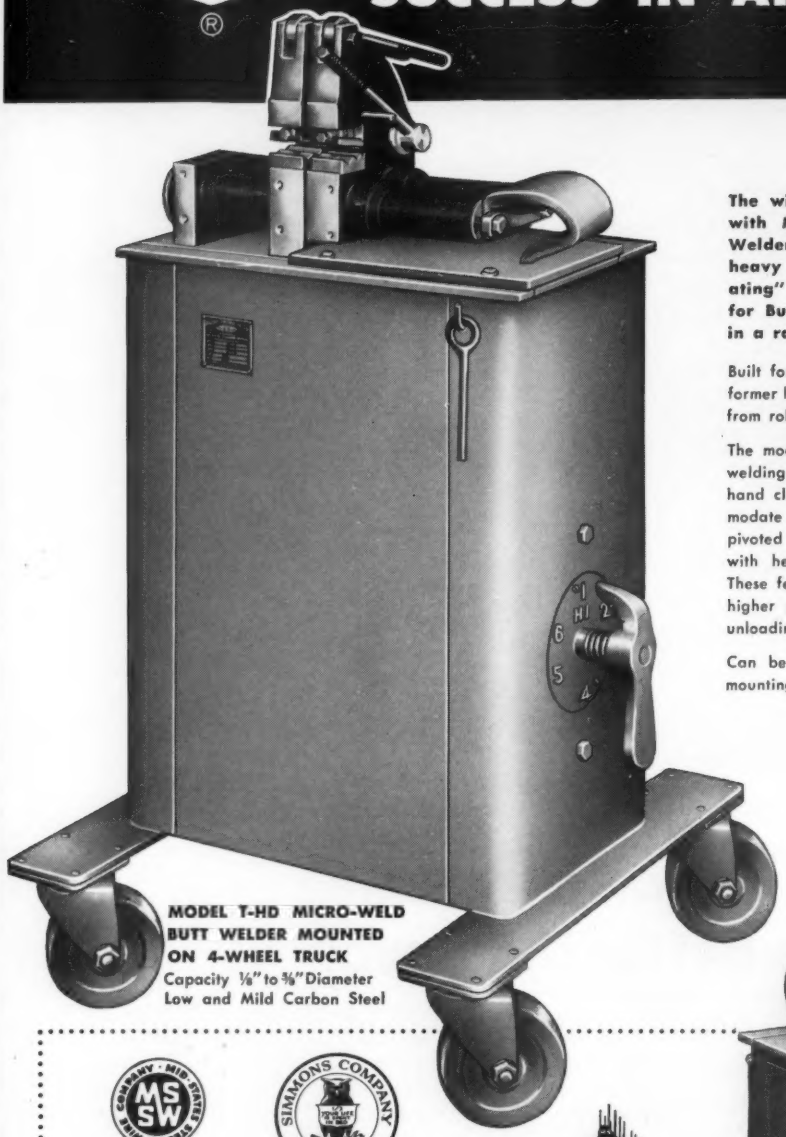
CARBOLOY
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

MICROMETER PRECISION – MICRO-WELD ®

CO-OPERATION . . . THE KEY TO SUCCESS IN ANY FIELD!



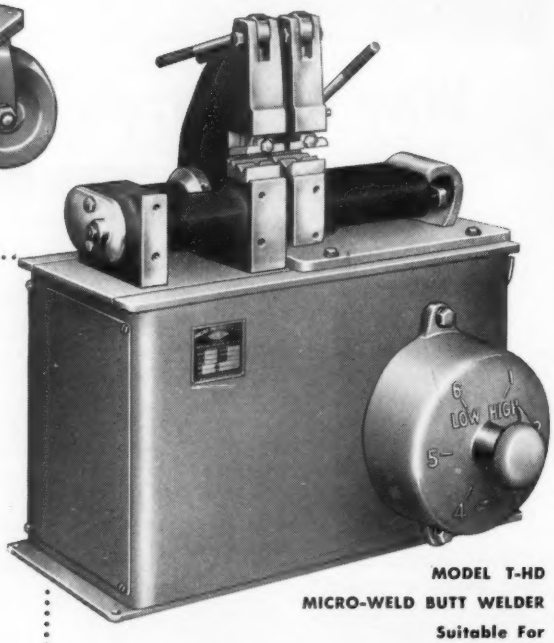
MODEL T-HD MICRO-WELD BUTT WELDER MOUNTED ON 4-WHEEL TRUCK
Capacity ⅛" to ⅜" Diameter
Low and Mild Carbon Steel

The wire industry of the American hemisphere co-operating with MICRO PRODUCTS COMPANY developed efficient Butt Welders for the world of wire . . . Model T-HD MICRO-WELD heavy duty Butt Welder has proven it's worth in "co-operating" with cold heading equipment, and other requirements for Butt Welding low and mild carbon steel wire and rods in a range of ⅛" to ⅜" diameter.

Built for heavy duty service, headpieces are made from bronze, transformer housing and truck are combined into a substantial unit, fabricated from rolled steel plates and arc welded.

The model T-HD MICRO WELD Butt Welder is a general purpose butt welding machine, equipped with manual spacing mechanism, individual hand clamps, manual spring upset mechanism, welding dies to accommodate the full range of sizes without changing dies, self-equalizing pivoted clamping shoes operated through simple positive cam clamps with heavy inserted coil springs to compensate for size variations. These features together with conveniently located controls contribute to higher production with a minimum of time required for loading and unloading.

Can be supplied mounted on 4-caster wheels or suitable for bench mounting.



MODEL T-HD MICRO-WELD BUTT WELDER Suitable For Bench Mounting

MSW COMPANY · MID-STATES STEEL & WIRE

SIMMONS COMPANY

ACCO

TRADE MARK

CONTINENTAL STEEL

LACLEDE

STELCO

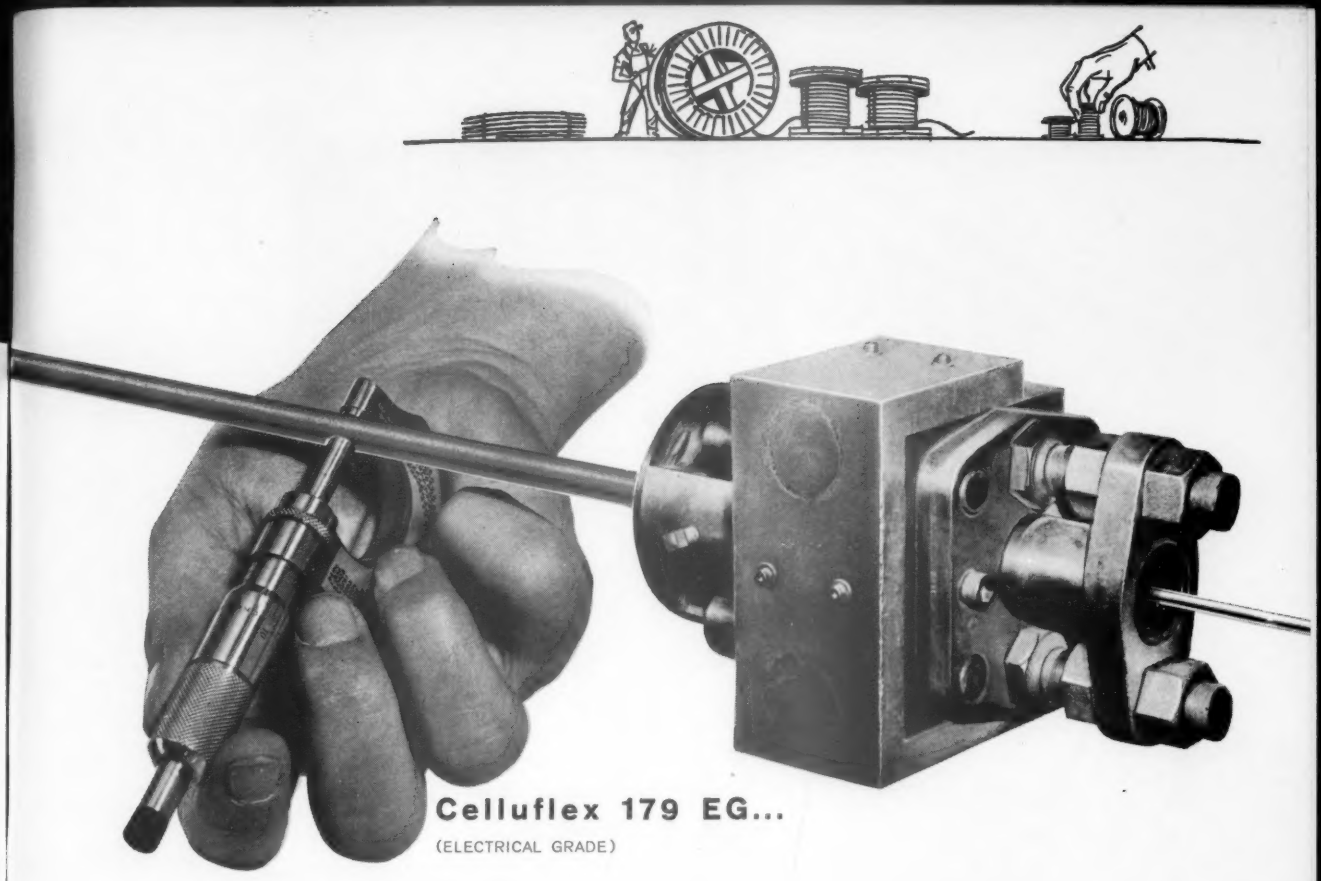
CF&I

These are some of the users of model T-HD MICRO-WELD Butt Welders.

MICROMETER PRECISION – MICRO-WELD ®

MICRO PRODUCTS COMPANY

20 NORTH WACKER DRIVE • CHICAGO 6, ILLINOIS • TELEPHONE STate 2-7168



Celluflex 179 EG...

(ELECTRICAL GRADE)

selected for dependability and ease of processing

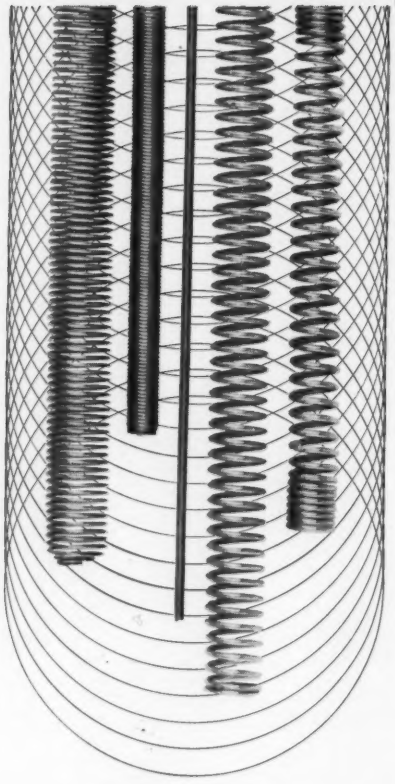
... add excellent volume resistivity, low volatility, fire resistance, excellent solvating action, oil and water resistance ... result: a tricresyl phosphate specially developed for the wire and cable industry for application in vinyl coverings.

Celanese is an expanding source for plasticizers for many jobs. Shipments from convenient distribution points are ready to meet tight schedules.
Write Celanese Corporation of America, Dept. 590-E, Chemical Division, 180 Madison Avenue, New York 16, N. Y., for complete information.
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Celanese® Celluflex® Lindol®

Celluflex 179 EG ... a Celanese CHEMICALS plasticizer

Call Celanese for: Tris-beta Chlorethyl Phosphate ... *CELLUFLEX CEF*; Epoxy Plasticizers ... *CELLUFLEX 21 and 23*; Four grades of flame-retardant Tricresyl Phosphate ... *LINDOL (low color)* ... *CELLUFLEX 179A (low specific gravity)* ... *CELLUFLEX 179C (general purpose grade)* ... *CELLUFLEX 179EG (electrical grade)*; Cresyl Diphenyl Phosphate ... *CELLUFLEX 112*; Dibutyl Phthalate ... *CELLUFLEX DBP*; Dioctyl Phthalate ... *CELLUFLEX DOP*; Triphenyl Phosphate ... *CELLUFLEX TPP*.

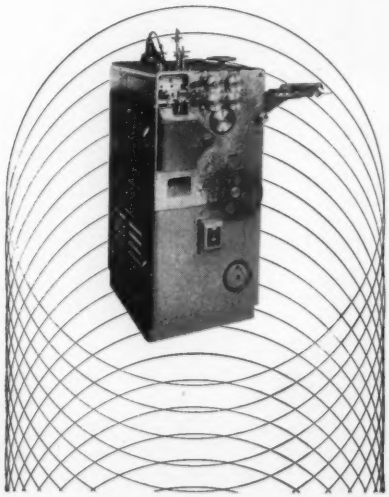


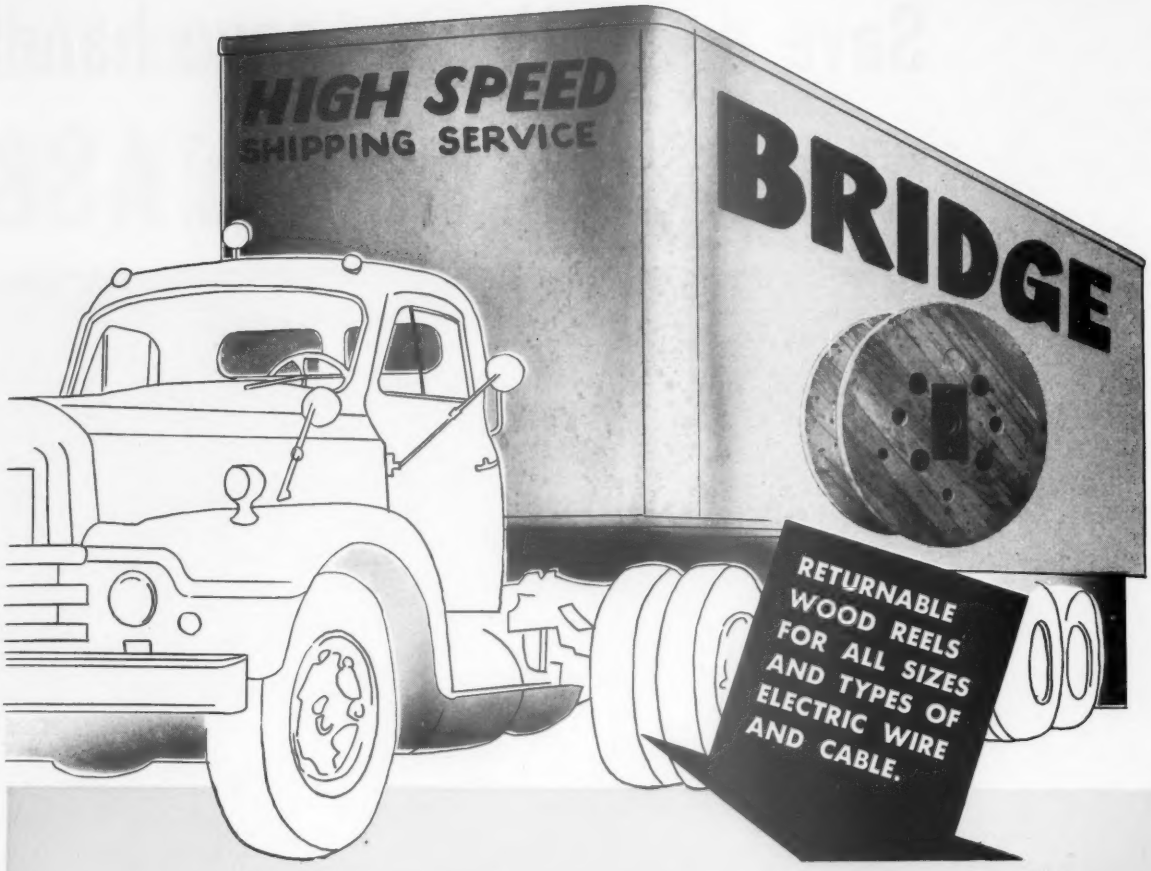
NEW TORRINGTON MULTIPLE WIRE FEED MECHANISM IS THE INDUSTRY'S MOST IMPORTANT ACCESSORY DEVELOPMENT IN 20 YEARS

This is an attachment which virtually doubles the versatility of segment-type spring coilers. By providing multiple stroke feed—with automatic pre-setting for any number of successive strokes—conventional springs can be produced *at any desired length*, and up to twice as fast as on a clutch-type coiler of equivalent size! ▪ Meanwhile, the operation retains the inherent accuracy of the segment coiler, and the use of the pitch, diameter and cutter mechanisms. ▪ Full data, specifications and engineering service upon request.

THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO



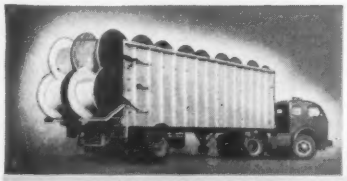


EVERY TYPE OF WOOD REEL—

Returnable or Non-Returnable for the WIRE INDUSTRY . . . from 10" to 10' in diameter.

STRAIGHT LINE production methods produce accurately-made REELS of HIGHEST QUALITY at prices that make it good business to buy from BRIDGE.

A completely MODERN plant, with the very FINEST and FASTEST equipment, much of it specially designed for BRIDGE, assures you of rapid SERVICE and STRONG SERVICEABLE REELS.



HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

RETURNABLE REELS ARE BUILT TO PROVIDE MANY TRIPS WITHOUT REPAIRS.

"REEL GOOD . . .

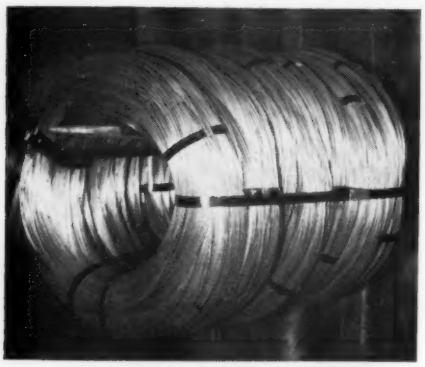
Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

Save down time... save handlingtime

order your wire in AS&WIRE

Other important time- and space-saving AS&Wire



UNITIZED COILS

Several regular mill coils bound in one unit to speed up handling and save storage space. Unitized coils carry no price extra!

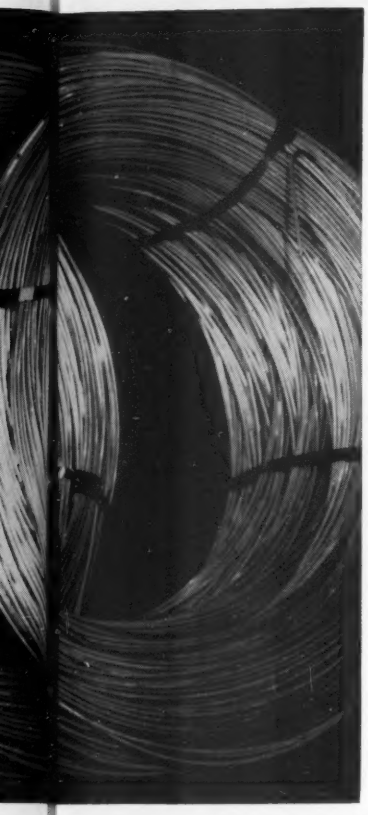
PAY-OFF DRUMS

Large, fibre, disposable drum containing long continuous coil. Pay-Off Drum is easy to handle and stack, protects wire finish from dirt and corrosive atmospheres.

DISPOSABLE SPOOLS

Contain from 5 to 65 pounds of fine wire. These non-returnable spools are convenient to handle and stack. Where wire is needed in large quantities, they can be shipped 36 spools on a pallet.

...time... save storage space...
...NEW HEAVYWEIGHT COILS



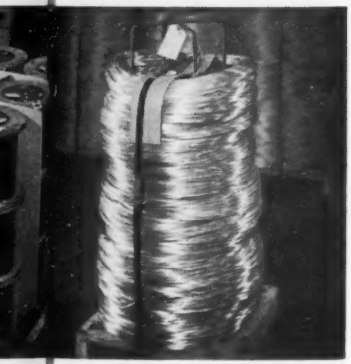
These large coils of continuous wire—up to 2,000 pounds—are designed by American Steel & Wire to help speed up your plant operation, increase your production—at no extra increase in wire cost.

With these large coils in place of regular mill coils, your machines stay in operation much longer, thus reducing down time costs. You save on handling time. You have only one wire coil to move in place of several. You save on storage space. One large coil takes up less room than several smaller ones.

FOR MILLS: Where Heavyweight Coils are not practical, American Steel & Wire supplies Manufacturers Wire in a variety of other time- and space-saving packages.

USS American Manufacturers Wire

...S&Wire Packages:



...LATFORM COIL CARRIER
...de of U-shaped wire frame at-...hed to deck platform; holds up to ...00 pounds of wire in continuous ...gths.

All of these new American Steel & Wire Packages are planned to serve you better, to help you use warehouse space to better advantage, to save time and money.

For more information, get in touch with the nearest district office of American Steel & Wire. General Offices: American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS and American are registered trademarks

American Steel & Wire
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United States Steel

USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal and Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

new, cost-reducing chemical for ACID PICKLING BATHS

AMCHEM SERSEAL* reduces heating requirements up to 70%, improves working conditions!

BEFORE SERSEAL, steam vapors and fumes escape from the bath, making working conditions unpleasant, lowering morale.

SERSEAL HAS BLANKETED THE BATH in just 10 seconds. All steam, corrosive fumes and vapors are contained within bath.

Put these 7 important Serseal advantages to work for you!...

1. Save up to 70% in heating costs.
2. Improve working conditions both from a comfort and health standpoint. Steam, heat, fumes and vapors are contained within the bath.
3. Cut warmup time. The blanket prevents heat loss.
4. Less corrosion of surrounding equipment. Corrosive fumes are retained in the bath.
5. Reduce the cost for heating elements.
6. Less exhaust equipment required. Since the bath is sealed, there is little escape of fumes and vapors. And in many cases, ventilating systems can be safely eliminated.
7. Now proving its economy, efficiency and overall satisfaction in many customer plants.

Write today for complete information about this important new cost-reducing, work-saving chemical blanket for acid pickling baths! Address Ambler 50, Pa.

AMCHEM

*Patent applied for **SERSEAL**

Amchem Serseal is another chemical development of **Amchem Products, Inc.** (Formerly American Chemical Paint Co.) AMBLER 31, PA. • Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont. • Amchem is a registered trademark of Amchem Products, Inc.

pan american

Exclusive Sales Office for USA and Canada

of leading West German manufacturers of Wire and Strip Working Machinery

INVITES

Executives of the Wire and Wire Working Industries to participate in a tour of the West German Industrial Establishments in conjunction with their visit to the European Machine Tool Exhibition in Paris in September, 1959.

The 16-day Air Tour, personally directed by Severin R. Rodin, President of PAN AMERICAN SUPPLY COMPANY, offers the rare opportunity to study the growing German Wire Industry and to see the newest Wire Equipment in operation.

Because the participation is limited, call, wire or write for further information, including rates, to:

Severin R. Rodin, *President*

Pan American

Pan American Supply Company

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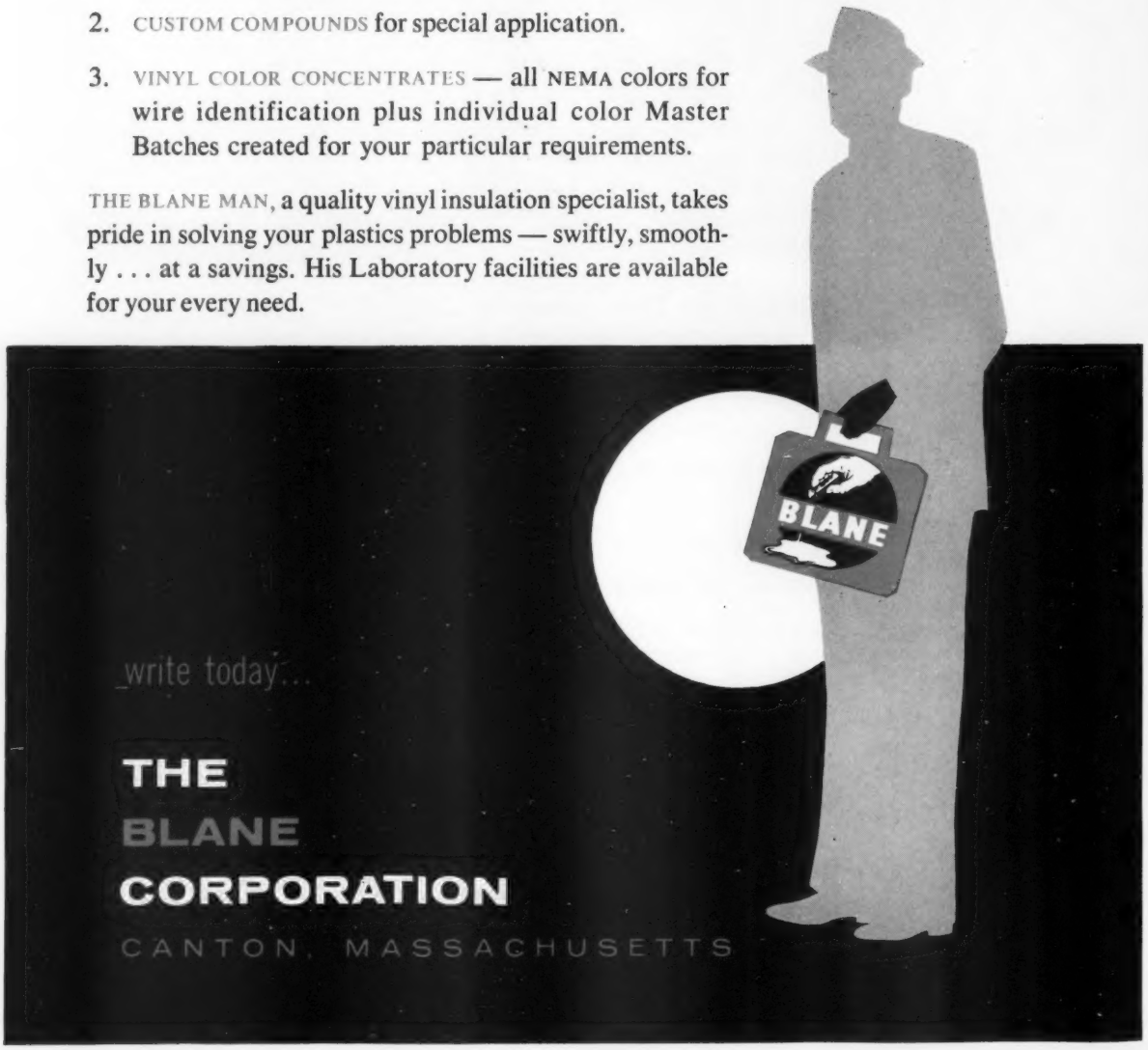
wire and cable industry... **THE BLANE MAN SERVES YOU!**

1. COMPOUNDING a complete line of vinyl molding and extrusion compounds.
2. CUSTOM COMPOUNDS for special application.
3. VINYL COLOR CONCENTRATES — all NEMA colors for wire identification plus individual color Master Batches created for your particular requirements.

THE BLANE MAN, a quality vinyl insulation specialist, takes pride in solving your plastics problems — swiftly, smoothly . . . at a savings. His Laboratory facilities are available for your every need.

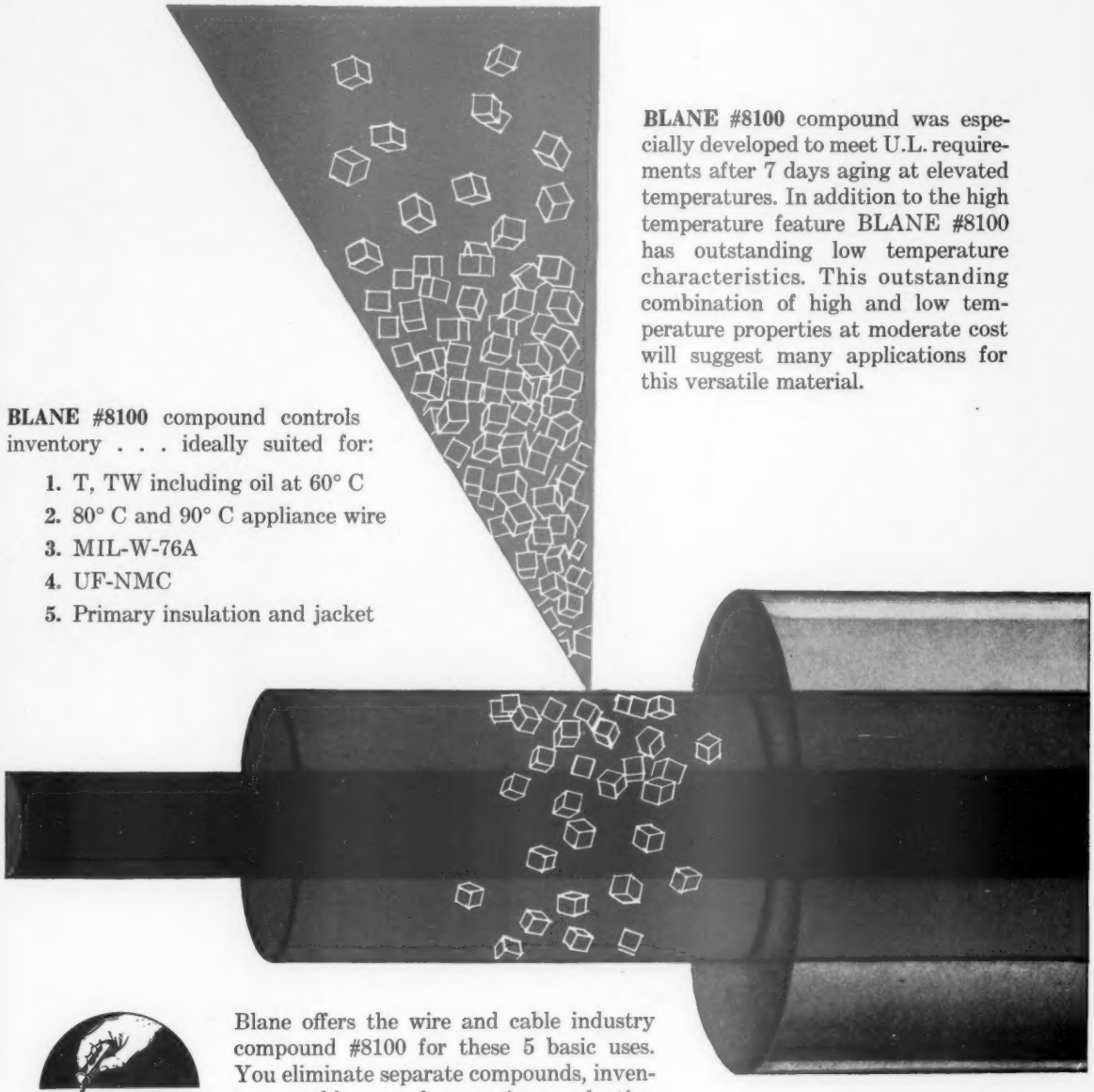


write today...

THE BLANE CORPORATION

CANTON, MASSACHUSETTS

NEW BLANE COMPOUND #8100 GIVES YOU EXCEPTIONAL VERSATILITY



BLANE #8100 compound was especially developed to meet U.L. requirements after 7 days aging at elevated temperatures. In addition to the high temperature feature BLANE #8100 has outstanding low temperature characteristics. This outstanding combination of high and low temperature properties at moderate cost will suggest many applications for this versatile material.

BLANE #8100 compound controls inventory . . . ideally suited for:

1. T, TW including oil at 60° C
2. 80° C and 90° C appliance wire
3. MIL-W-76A
4. UF-NMC
5. Primary insulation and jacket

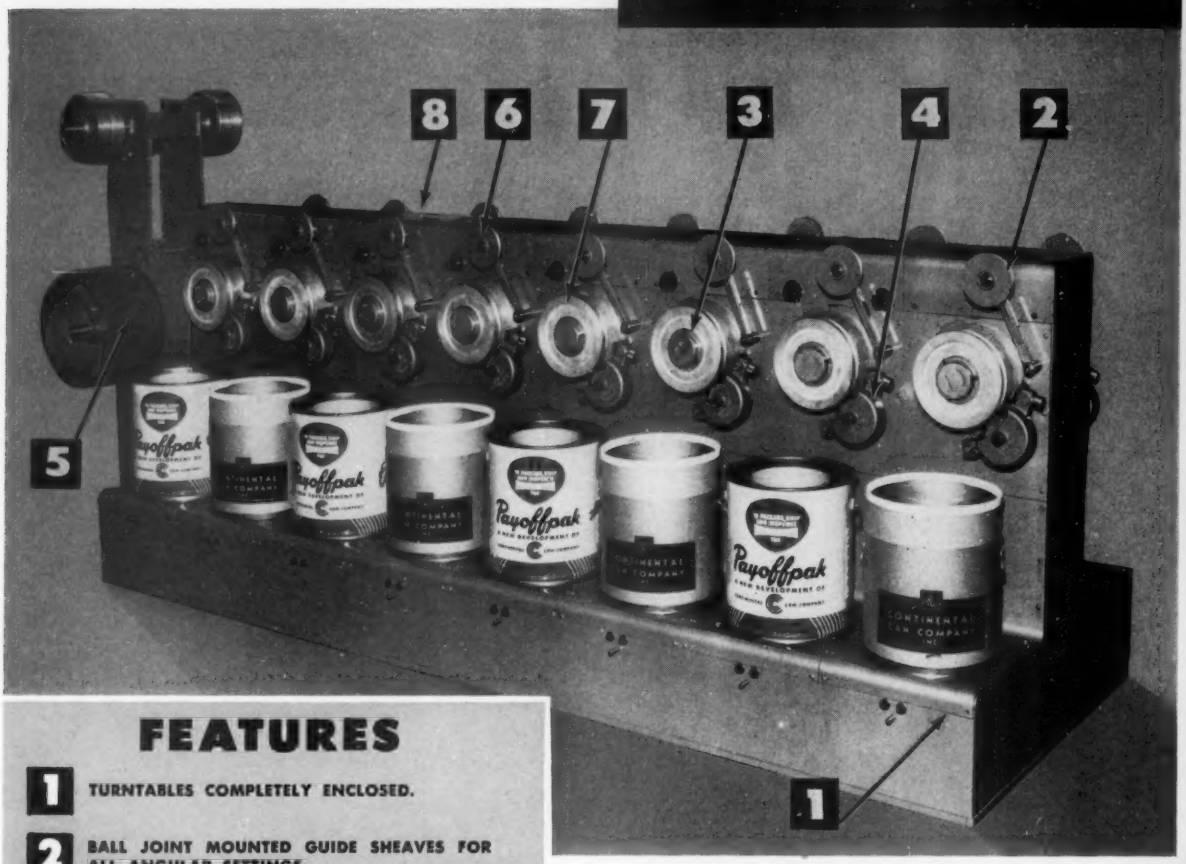
BLANE

Blane offers the wire and cable industry compound #8100 for these 5 basic uses. You eliminate separate compounds, inventory problems and expensive production delays. This compound has a smooth surface appearance and a superior extrusion rate. Write for samples and technical data, today!

THE BLANE CORPORATION

38 PEQUIT STREET • CANTON, MASS.

ANNOUNCING the WYREPAK



FEATURES

1. TURNTABLES COMPLETELY ENCLOSED.
2. BALL JOINT MOUNTED GUIDE SHEAVES FOR ALL ANGULAR SETTINGS.
3. ELECTRO-MECHANICAL TENSION CONTROL FOR EACH HEAD.
4. PRECISION GROUND PRESSURE ROLLS.
5. PRIME RUBBER LAGGED CAPSTAN.
6. ASSEMBLED AND ALL ADJUSTMENTS MADE WITH ALLEN SCREWS.
7. ALUMINUM CAPSTANS, WITH HARD-ANODIZED, POLISHED RUNNING SURFACES.
8. INDIVIDUAL MAINTENANCE ON EACH SECTION.

The drum packaging Take-Up System illustrated, Model S5-TC-S, was designed especially for Magnet Wire.

Other models are made for all types of ferrous and non-ferrous wires.

Advanced engineering and precision construction have evolved in this machine new concepts of speed and efficiency in the packaging of wire. Capacity: Min. size — #32 ga.; max. size — #20 ga. wire.

YOU ARE INVITED TO SECURE COMPLETE DETAILS REGARDING THIS ADVANCED PROCESS FROM —

Advanced Wyrepak Co., Inc.

11 HARRISON COURT PHONE: EDison 4-4274 BRIDGEPORT, CONN.

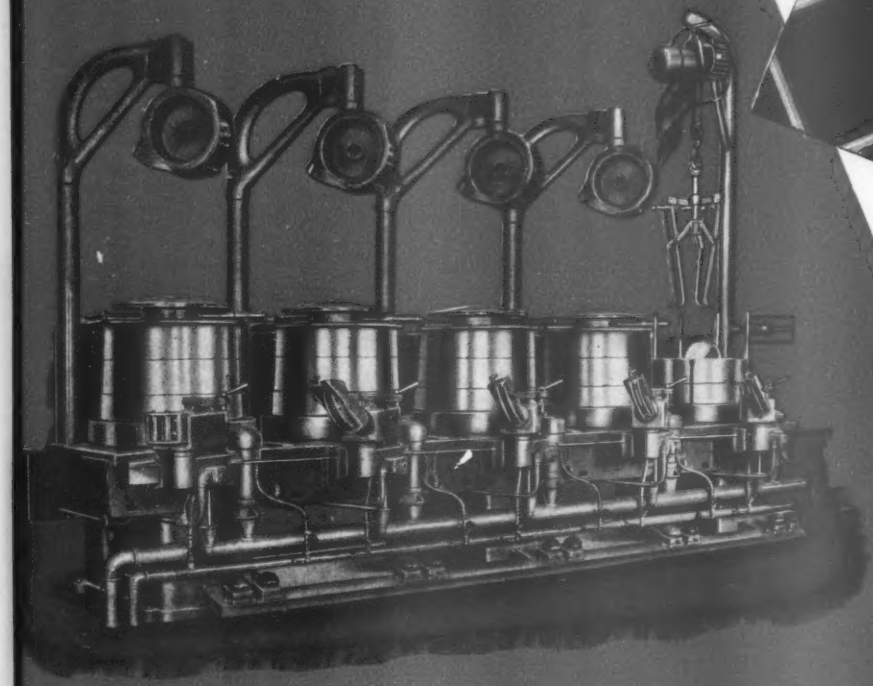
OR The Vaughn Machinery Co., CUYAHOGA FALLS, OHIO

HERBORN

Non-Slip
Continuous

Wire Drawing Machines

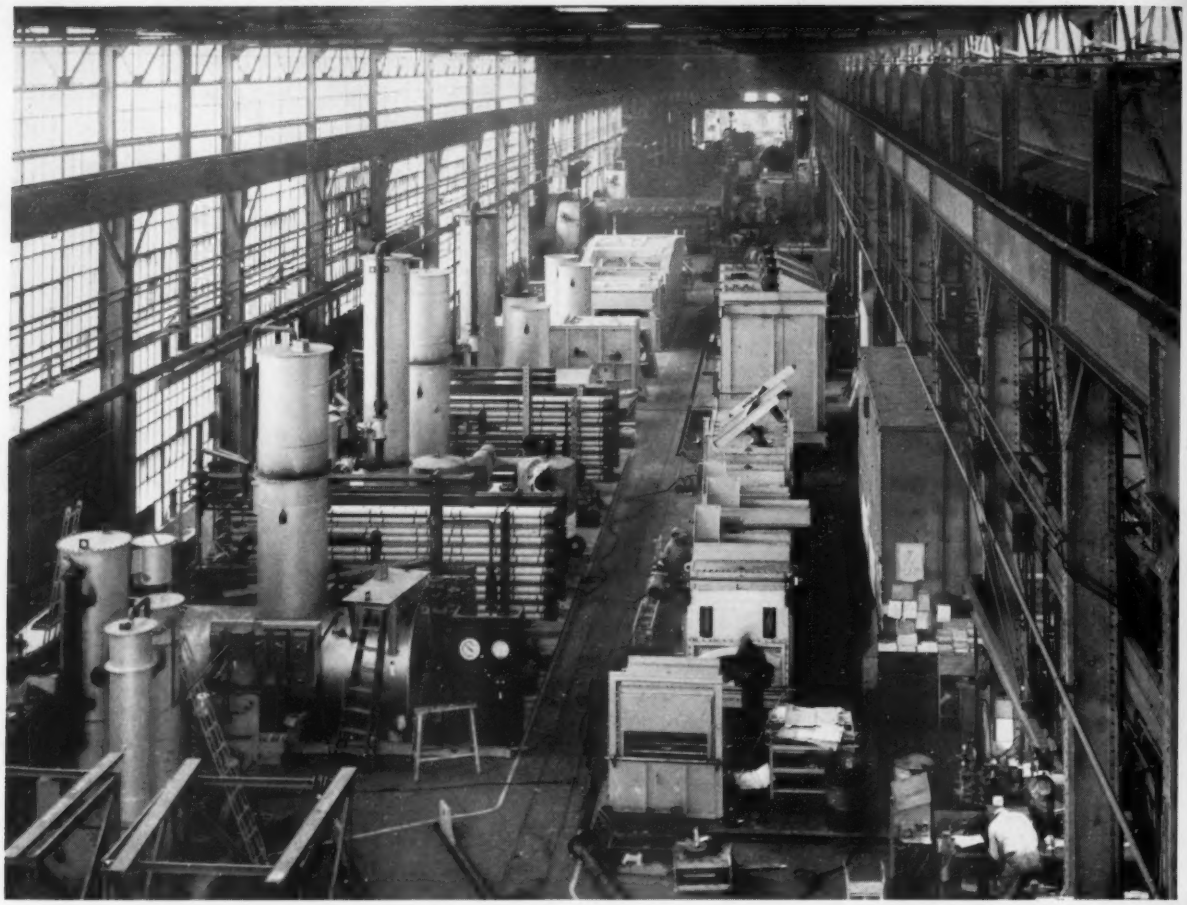
For Low Carbon and
High Carbon Steel Wire



Please send your
inquiries to

MASCHINENFABRIK HERBORN BERKENHOFF & DREBES A.-G. **HERBORN/DILLKREIS** GERMANY

HERBORN MACHINERY CORPORATION, 61 Hudson Street, HACKENSACK, N. J.



THE FINEST FACILITIES

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To build "The Best Industrial Furnaces Made"... at the lowest possible cost... the finest facilities in the furnace industry are needed. Sunbeam Equipment Corporation now has those facilities.

The recent acquisition of the Westinghouse Industrial Furnace business including patents, design, spare parts and repair services means that now, more than ever before, Sunbeam will handle *every* industrial furnace, from the smallest to the largest... design through installation.

The large Sunbeam plant at Meadville, Pennsylvania has the *most complete equipment* and facilities, including a 400-ton press brake and plate and angle rolls, an automatic shot blasting machine and automatic welders, a complete machine shop and numerous assembly bays.

Engineers, bricklayers, millwrights, electricians and other highly skilled craftsmen help Sunbeam Equipment Corporation live up to its reputation. All types of furnaces are built and tested at Meadville. The plant includes excellent *inside* loading docks for shipping by rail or truck.

To take advantage of the best facilities to "Build the Best Industrial Furnaces Made" for your business, send an outline of your needs or write for the name of your nearest Sunbeam representative today.

Sunbeam
THE BEST INDUSTRIAL FURNACES MADE

Sunbeam EQUIPMENT CORPORATION
Dept. 252 • 198 Mercer St. • Meadville, Penna.
Fuel-Fired or Electric Furnaces • *Atmosphere Generators*

Roebling Wire in convenient bulk packaged to make your products easier

If you use high-carbon wire in sizes from .060" diam. to .030" diam., it will pay you to investigate Roebling's Reel-less Core Packaging System. This method offers you substantial savings in several ways—to say nothing of the quality wire that Roebling always delivers in any kind of package.

Here's how simple it is:
Cores are palletized two cores per pallet and can be stacked two or three pallets high (think of the saving in storage space).

Empty reels are not accumulated because there are no reels to store, send back, bookkeep, get credit on, or pay shipping charges on (either way). Just unwrap the wire, set it up the way you see here, and there you are. Where a limited number of reel-less core packages are used, or where wire is flipped from reels mounted in a horizontal position, the tilt table is not necessary.

This method is typical, indeed, of Roebling's efforts to make quality easier to handle and to banish the problems that cost you time, money and sharp pains across the brow.

Full details of wire without reels will be immediately forthcoming when you write Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

HERE'S WHY LEADING MANUFACTURERS

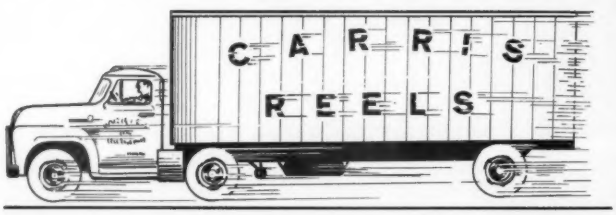
CHOOSE CARRIS

CARRIS MANUFACTURES THEIR OWN PLYWOOD TO GIVE YOU EVEN BETTER REELS

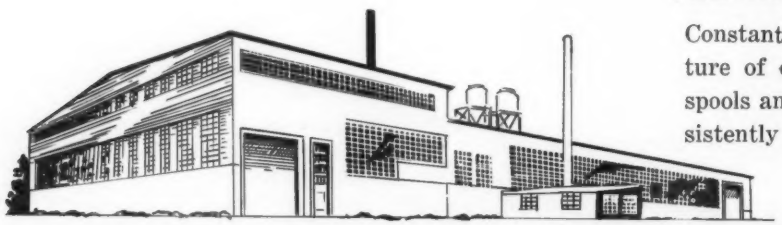
So that we may make sure that all our spools and reels are of high quality, and so that we may consistently make them available to our customers at the lowest possible cost, we make all our own plywood. Since it is made especially for use in spools and reels, better grade products result.

CARRIS OFFERS FAST DELIVERY WITH THEIR OWN FLEET OF TRUCKS

There is never a need for Carris customers to waste valuable space storing a surplus of spools and reels. They may order them as they need them, for in addition to our regularly scheduled trips, we also offer special trips throughout our delivery areas.



YOUR REELS ARE QUALITY-CONTROLLED EVERY STEP OF THE WAY IN OUR MODERN PLANT



Constant supervision during the manufacture of our products, from logs to finished spools and reels, means Carris quality is consistently high. And the efficient straight-line production methods used in our modern plant keep costs down.

CARRIS REELS, INC.

RUTLAND, VERMONT

SPECIALISTS IN THE DESIGN AND MANUFACTURE OF PLYWOOD REELS AND SPOOLS

SHUSTER 1AVS

ANNOUNCING

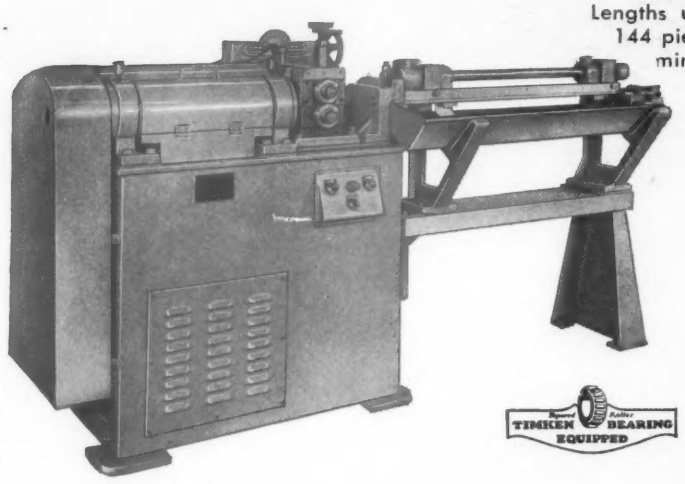
FOR 93rd ANNIVERSARY

SHUSTER MODEL IAVS 1/4" CAPACITY
Wire Straightening and Cut-Off Machines

CAPACITIES
.062" to .148" spring wire
.062" to .250" basic wire
50 to 200 F. P. M.

The Production Booster with infinite variable speed control and The New Electro Mechanical Positive Release Target

Production:
Lengths up to 13"
144 pieces per minute



The BEST is *STANDARD* with SHUSTER!

Illustrated is the new IAVS SHUSTER AUTOMATIC WIRE STRAIGHTENING and CUT-OFF MACHINE. Many new features are included as Standard Equipment on this High Speed 1/4" capacity machine.

Features include: High Speed Straightening Arbor with elongated split dies for proper bearing surface and optimum straightening speed, new Shuster Electro-mechanical positive release target, with electrically controlled tripping mechanism to instantaneously operate roll type clutch. Feed roll housing and fly wheel are Timken bearing equipped All mechanisms are mounted on Shuster Welded Steel Base. Also included are new improved Guide Bar, Guide Bar Cover and a new Angled Control Panel together with properly engineered working height.

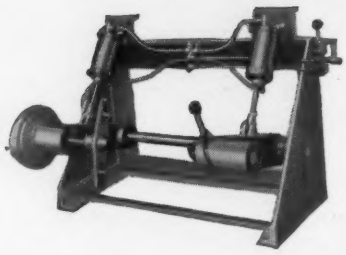
There are more SHUSTER in use throughout the world than all other machines of its type.

SHUSTER
Wire Straightening and Cut-off Machines and Components are built in 49 models from .020" to 11/16" Mettler Machine Tool also manufactures the SHUSTER 5/16" capacity. Thread Rolling Machines

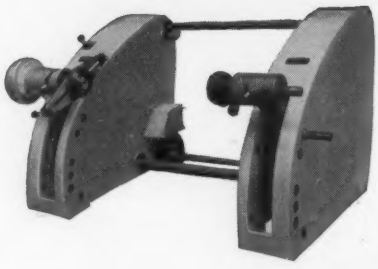
METTLER MACHINE TOOL, INC.

New Haven, Conn.

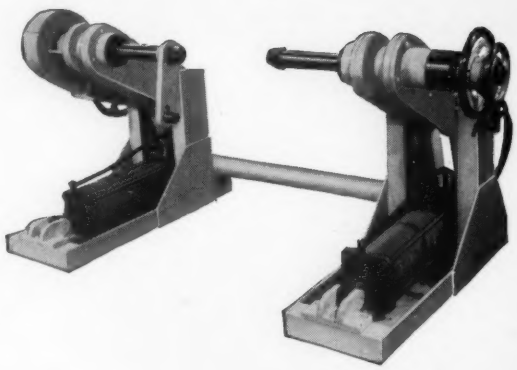
PAY-OFF & TAKE-UP EQUIPMENT FOR THE WIRE & CABLE INDUSTRIES



Units to meet any application in the manufacture of wire and electric cable. Shaftless types available from 350 lb. handling capacity up to 2 tons. Designed with the strictest economy of space and moving parts.



GENERAL ENGINEERING CO. (RADCLIFFE) LTD. are specialists in the design of equipment for many processes involved in wire and cable making. Their range of pay-off and take-up units includes shaftless and shaft types, with driven pay-offs, traversing reel take-ups and twin reel models. The shaftless types are of pivot arm construction with pneumatic or hydraulic lifting apparatus, and running, conical pintles, which accommodate different sizes of reels. These units are standardised with separate drive and traverse for the take-up units. Send for Bulletin 409 for more specific details.



We are exhibiting
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Olympia
17th - 27th June
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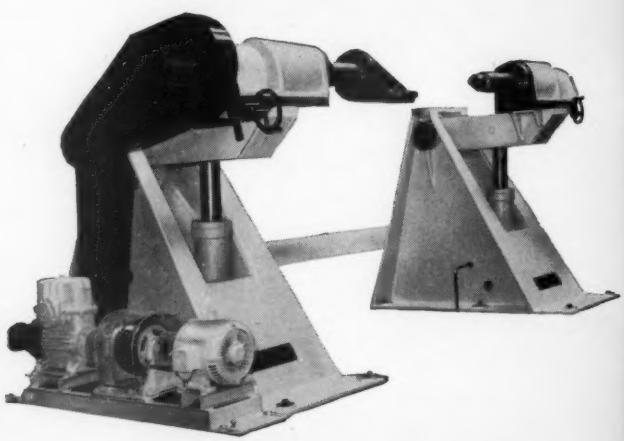


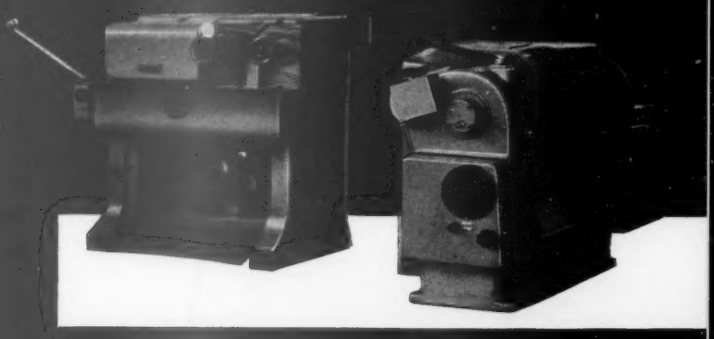
General Engineering Company (Radcliffe) Limited

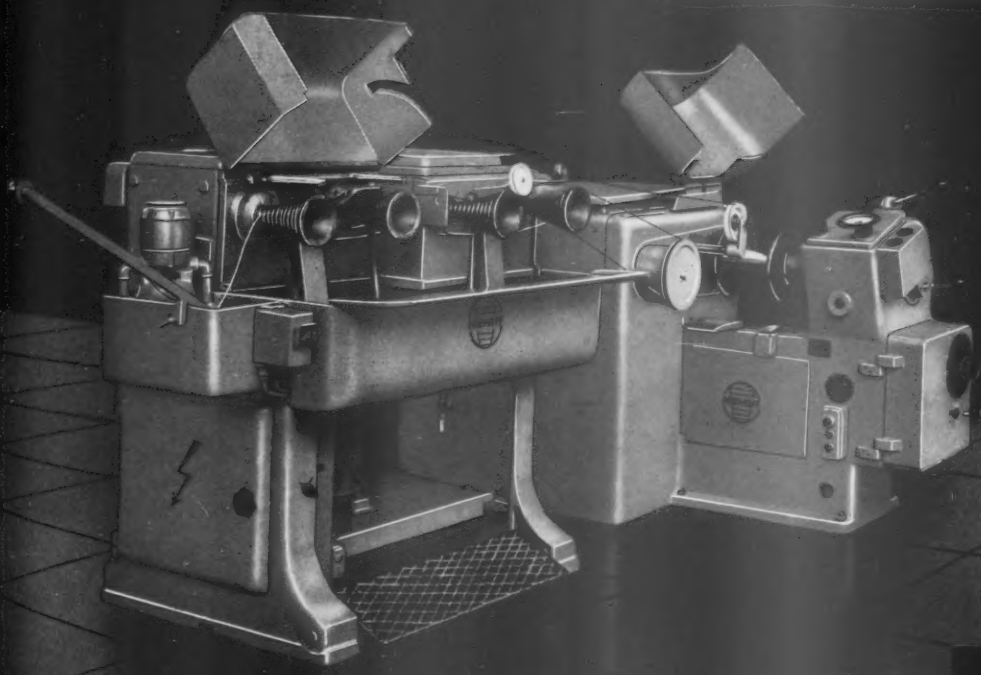
Station Works, Bury Road
Radcliffe, Lancs., England

Tel: 2291/4 (4 lines)
Telegrams: "General," Radcliffe, Manchester.

Represented in nearly every country in the world.

NIEHOFF WIRE DRAWING UNITS

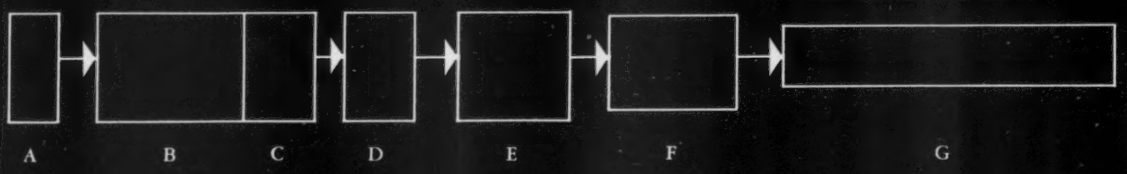




NIEHOFF MACHINE WORKS

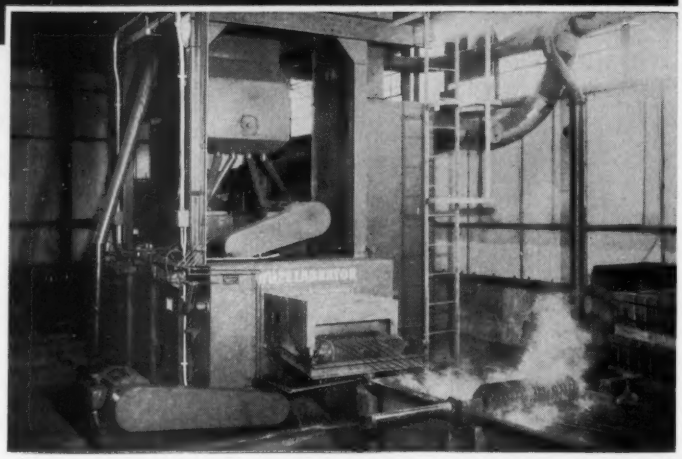
SCHWABACH NEAR NURNBERG WESTERN GERMANY

FROM HOT ROLLED ROD THROUGH PATENTING, CLEANING AND COATING IN ONE CONTINUOUS OPERATION



THE LESCHEN WIRE ROPE DIV. AUTOMATED STRAIGHT-LINE PRODUCTION METHOD

A. Twelve-strand Payoff Reels.
B. Rod Annealing Furnace.
C. Lead Quench (Patenting).
D. Water Quench.
E. Wheelabrator Abrasive Blast Descaling Cabinet.
F. Borax Coating and Drying.
G. Horizontal Takeup Recoilers.



Leading producers of wire products are now using Wheelabrator® straight-line abrasive blast descaling as the shortest distance between steel rod and wire profits. At H. K. Porter Company, Inc., Leschen Wire Rope Division, St Louis, for example, this process is resulting in exceptional production efficiency and economy.

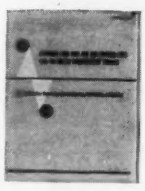
The automated processing line starts with hot rolled rod, and in one continuous operation produces cleaned and coated rod for subsequent drawing. Wheelabrator mechanical blast descaling is an essential step in this process. It cleans twelve strands at a time in line with patenting, coating and drying and delivers cleaned and coated rod for multiple hole drawing. There is no interruption and no intermediate handling required. Furthermore, the line operates continuously five days a week, 24 hours a day without downtime.

All scale or rust is completely removed down to virgin metal, at speeds required for patenting. The fine matte finish obtained holds a more uniform coating and provides excellent drawing characteristics. This blast descaling process offers freedom from the problems associated with acid pickling. And, through automated production, important additional savings in time and labor costs are achieved by reducing "in process" inventories.

It will pay you to consider this new process for cleaning any type of ferrous or non-ferrous hot rolled rod and bar stock for cold drawn products.

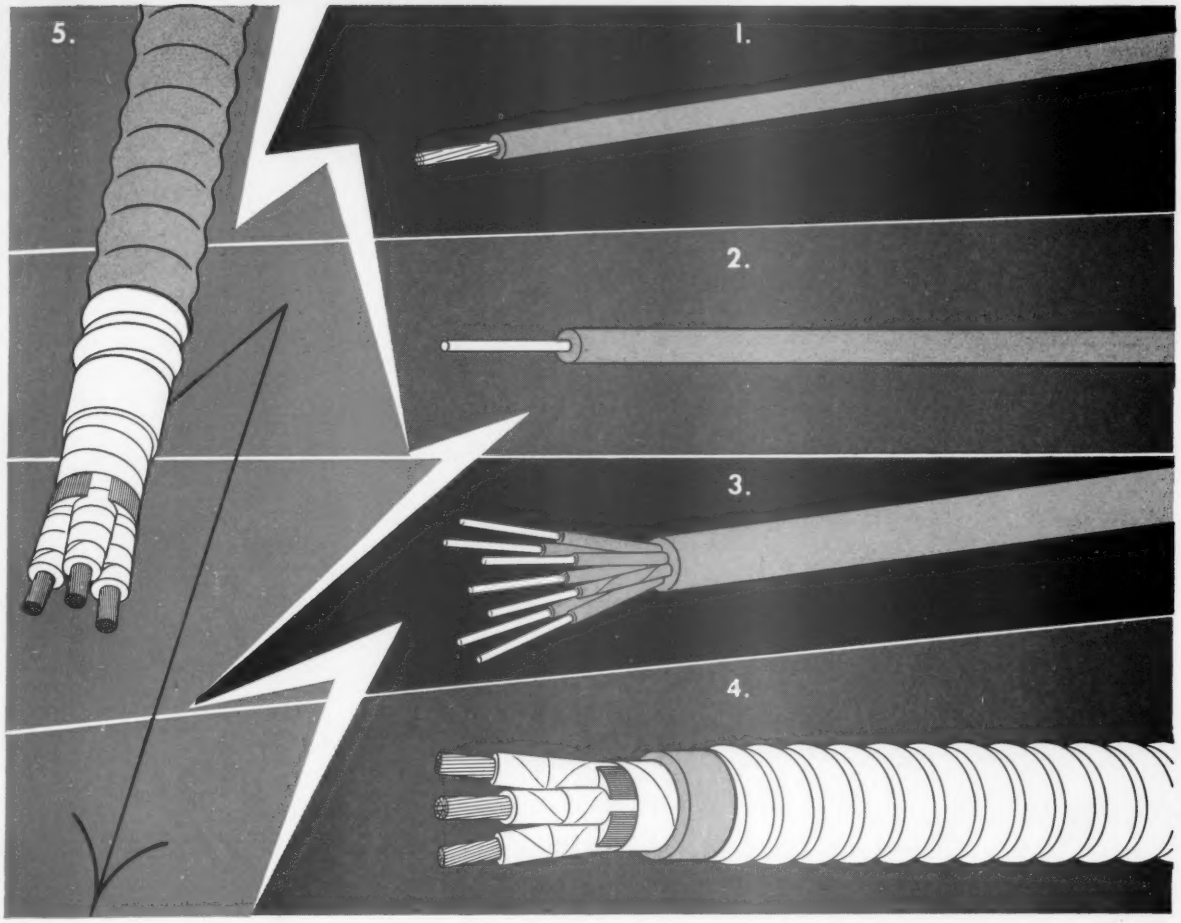
WHEELABRATOR
CORPORATION
389 South Byrkit Street Mishawaka, Indiana
Canadian Offices: Scarborough (Toronto) – Montreal

HOW TO AUTOMATE YOUR WIRE DRAWING LINE
This new booklet explains how Wheelabrator blast descaling can enable automation of your wire production. Write for Bulletin 148-D.



WORLD'S LARGEST MANUFACTURERS OF AIRLESS BLAST CLEANING EQUIPMENT AND STEEL ABRASIVES

Naugatuck MARVINOL POLYVINYL CHLORIDE RESINS



How General Electric uses Marvinol

Some of the finest electrical wire and cable comes from General Electric Company's Wire and Cable Department at Bridgeport, Conn. Here, polyvinyl chloride—much of it Naugatuck's Marvinol®—is used for a wide variety of purposes:

1. **As insulation** on Flamenol* single-conductor wire in the 0-600 volt class and on 2-conductor SPT rip cord for 300 volts.

2. **As both insulation and jacketing** on Flamenol* single-conductor cable for direct ground burial in street lighting series circuits up to 5000 volts.

3. **As jacketing** over rubber insulation of single- and multiple-conductor cable to provide protection against oil, acid, alkali, ozone and sunlight.

4. **As a thermoplastic jacketing** under the armor of G. E. varnished cambric interlocked armor cables to provide flame-, chemical- and moisture-resistance and slow aging.

5. **As a protective coating** over the metal armor of VCI cable where corrosive atmospheres are present. This vinyl coating may also be colored to provide circuit identification.

Whether you manufacture electrical wire, or any other type of wire product that can be made more attractive, more useful or more durable by the application of a vinyl covering, there's a Marvinol resin designed to do the job. Let's talk it over!

*Registered Trade-mark General Electric Company

United States Rubber

529M ELM STREET

Naugatuck Chemical Division, NAUGATUCK, CONNECTICUT

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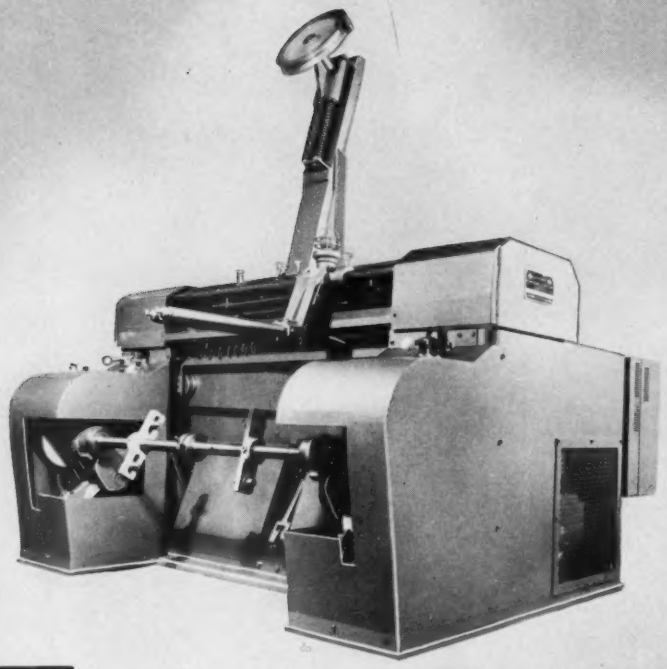
LOOK UP WITH



ENTWISTLE

THINGS DON'T HAVE TO LOOK DOWN BECAUSE OF A TIGHT BUDGET!

This "HOT" little number, of diamond quality, produces rocket performance at an attractive price.

YOU cannot buy any one shaft-type machine elsewhere that approaches the "TE" and "THE" Entwistle Dual Continuous Take-ups either in performance, features, or, as complete at any price. As a matter of fact, non-automatic, "warmed-over" passe' designs, available elsewhere, are in the same price range.

YOU can't afford to miss knowing about our new "TE" and "THE" shaft-type continuous take-ups for reels up to 1400 Lbs. at speeds to 2000 F.P.M.

YOU handle 24" through 36" O.D. reels on one machine.

Obtain full details including firm quotation.

YOU get these built-in features:

Eddy-current drive and controls.
Adjustable, maintained speeds and tensions.
Electric brakes and clutches.
Pneumatic lift and cut-off.
Infinitely adjustable traverse, pneumatically reversed.
Predetermined, Motorized traverse crossover.
Effortless, trouble free, silent service.
Includes wire reservoir tower and measuring.

WRITE, CALL, OR FLY . . . BUT — DON'T WAIT.

Ask for Entwistle "3C" — *"The Deal of The Century"*

ENTWISTLE

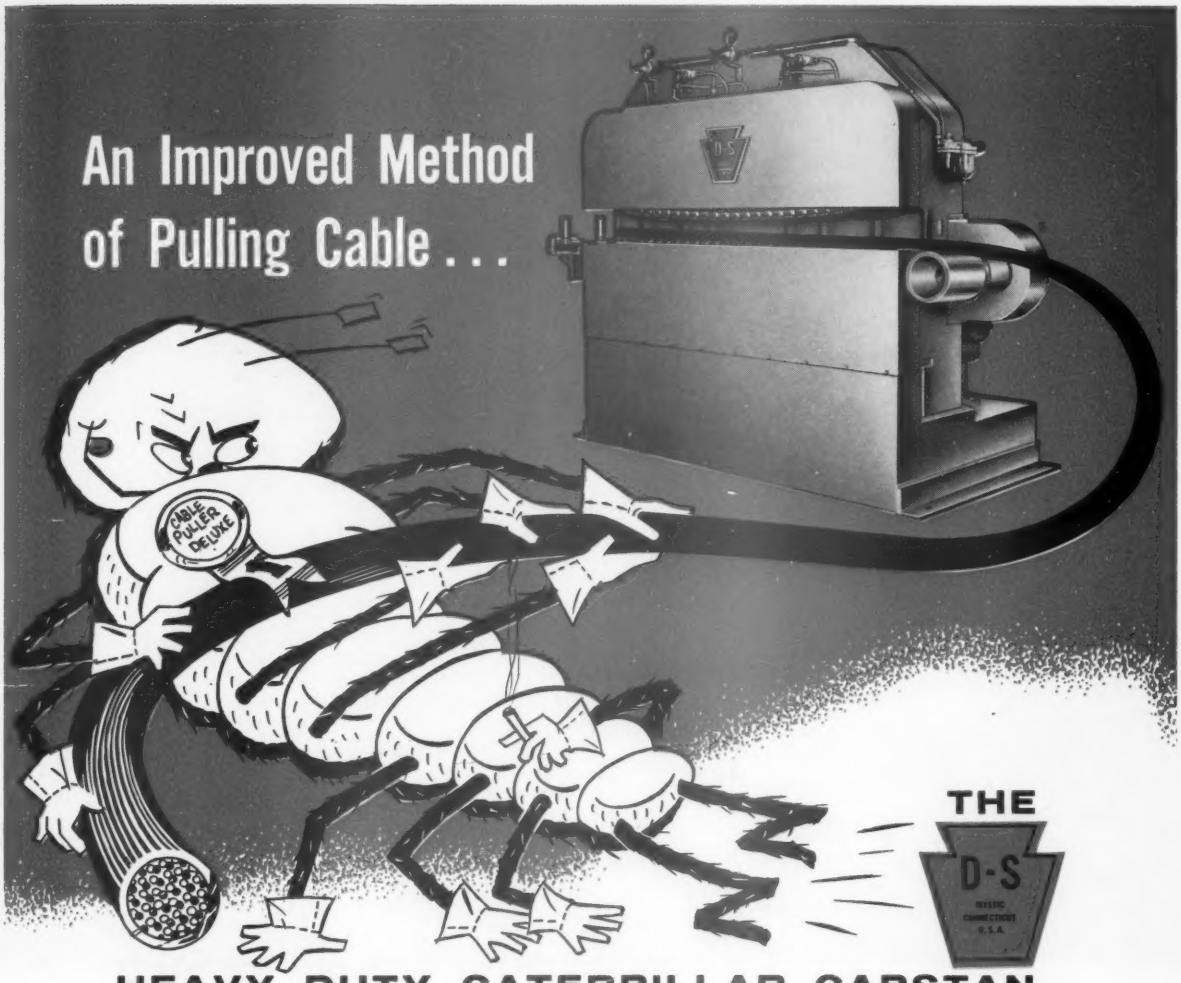
Manufacturing Corporation

1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

Over 40 years of dependable service to the Wire Industry

Europe, South America, Mexico
FOREL EQUIPMENT CORPORATION
30 Church Street, New York 7, New York

British Associates
THE KEMSON ENGINEERING CO., LTD.
Wellington Mill, Bolton Road
Blackburn, Lancs., England



HEAVY DUTY CATERPILLAR CAPSTAN

The D-S Caterpillar Capstan is specially designed to provide precisely controlled, heavy pulling power for large diameter cables. The increased gripping area and straight line pull of the caterpillar design prevents scuffing, fraying, and bending of heavy cables by the capstan.

- The D-S Caterpillar has a pull of up to 5000 lbs. on cable from extruder.
- Special tread grips *around* cable for maximum grip without insulation damage.
- 17 pairs of treads gripping constantly at up to 400 lbs. pressure, infinitely variable by air pressure control.
- Alternate tread materials available with resiliency, excellent friction, and abrasion resistance.
- Treads open and close on common cable centerline and are articulated to follow cable variations.
- Maximum cable speeds of 100 or 200 feet per minute. Other speeds available.
- An optional lead wire capstan allows wire rope to be attached to cable end to start cable through treads.
- Adjustable guides which center cable within the tread.

For further information write to:

D-S MYSTIC CONNECTICUT U.S.A.

DAVIS-STANDARD

Division of FRANKLIN RESEARCH CORPORATION

20 WATER STREET, MYSTIC, CONNECTICUT

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REPUBLIC "50" HIGH STRENGTH STEEL PALLETS

withstand temperatures over 900° at Anaconda Aluminum Company

Republic "50" High Strength Steel Pallets solved a particularly severe problem at the Anaconda Aluminum Company, Louisville, Kentucky, world's largest independent producer of aluminum foil.

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The low alloy steel used in producing Republic "50's" has a minimum yield point of 50,000 psi and a minimum tensile strength of 70,000 psi. It is the combination of basic alloy steel and Republic's extensive heat treating experience that gives these pallets the extreme strength needed for the job.

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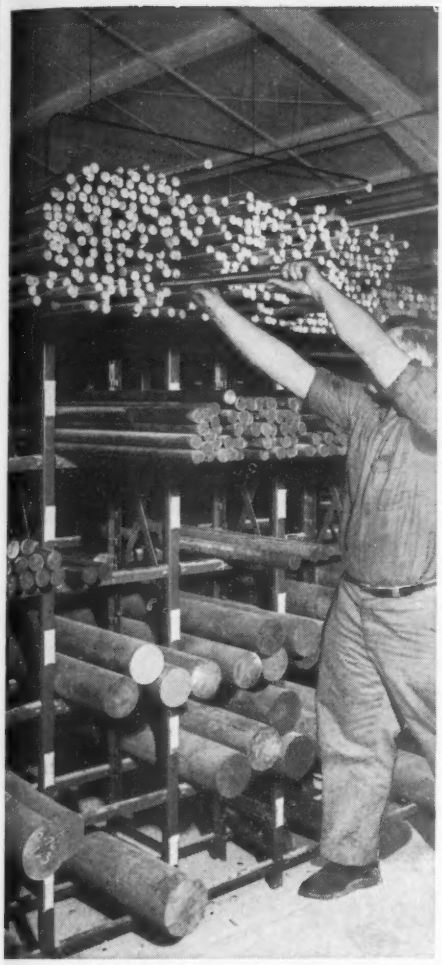

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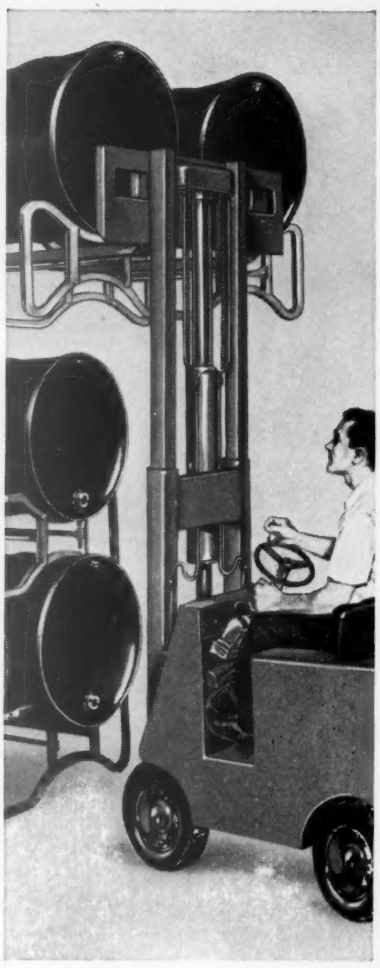

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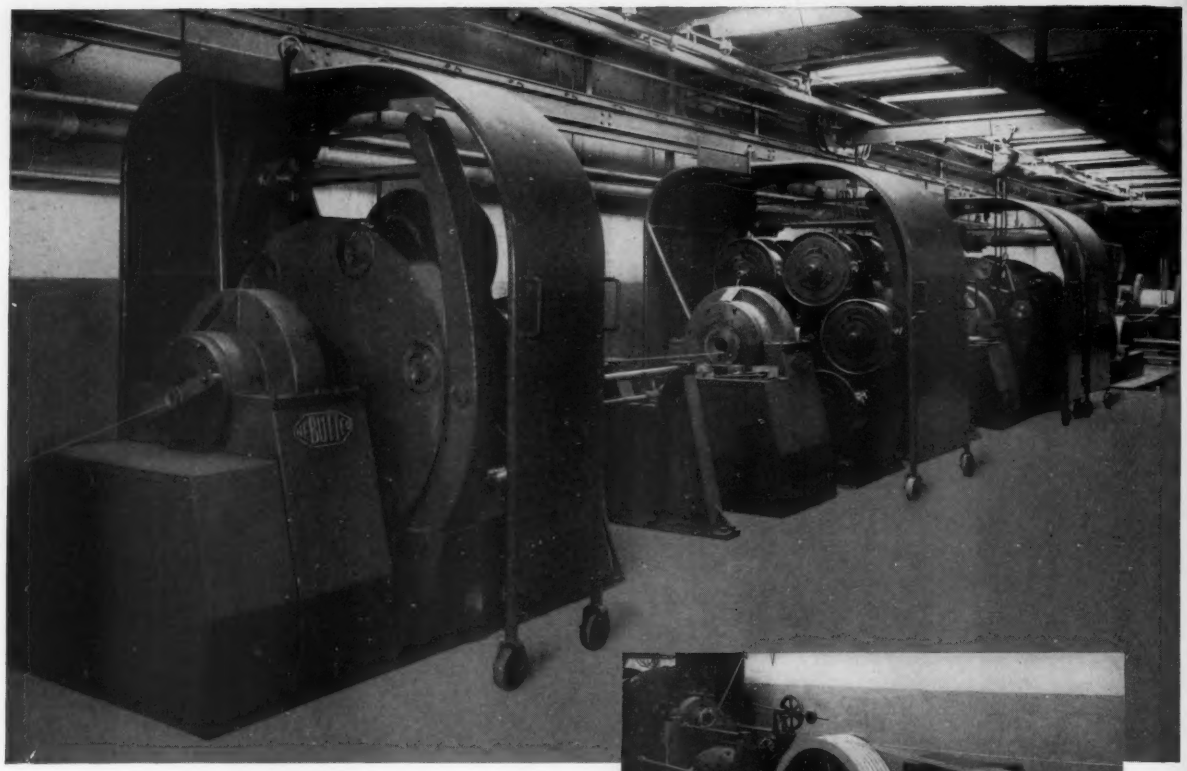

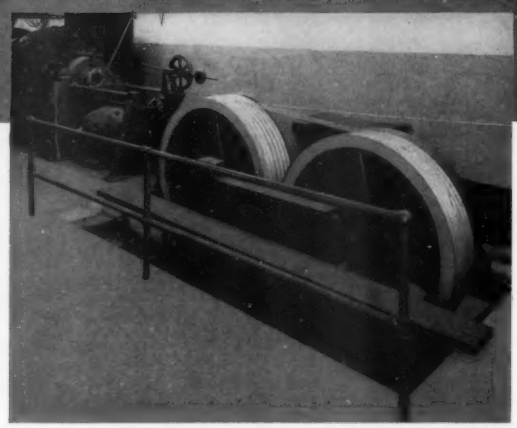

60" multi-groove capstans tilted for straight pull on cable without chafing. Both capstans are driven.

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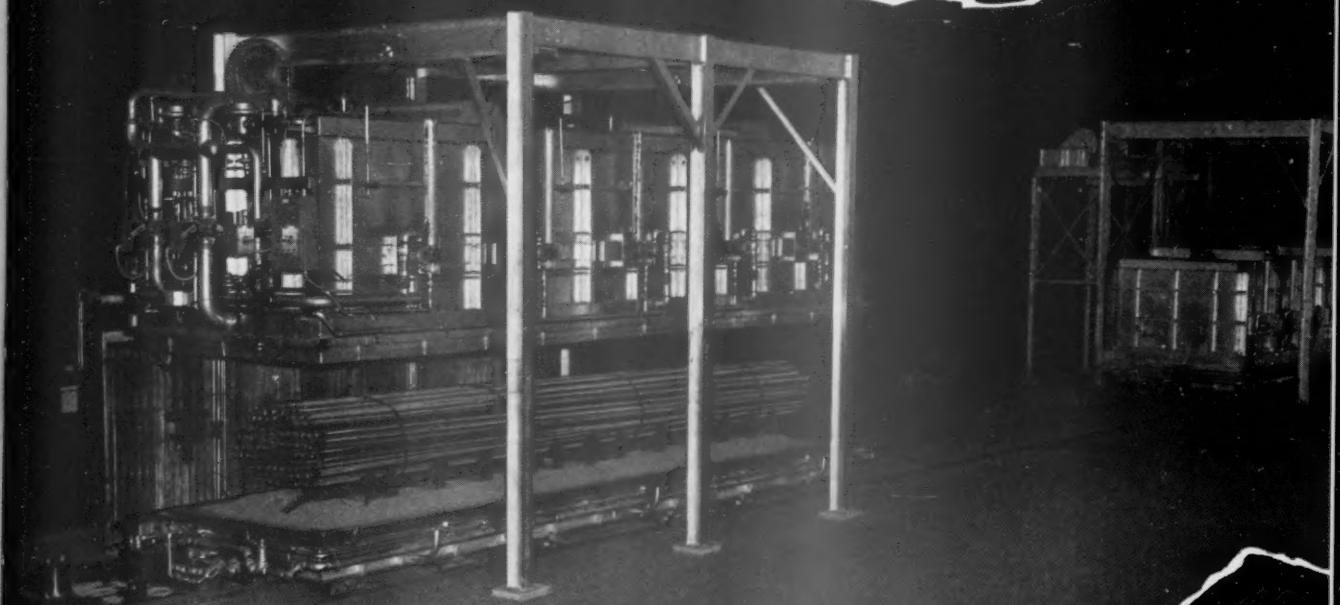

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These new furnaces process anneal, spheroidize and lamellar anneal to uniform physical properties because the heat is applied more uniformly and controlled with greater precision. Proper atmospheres protect against decarburization.

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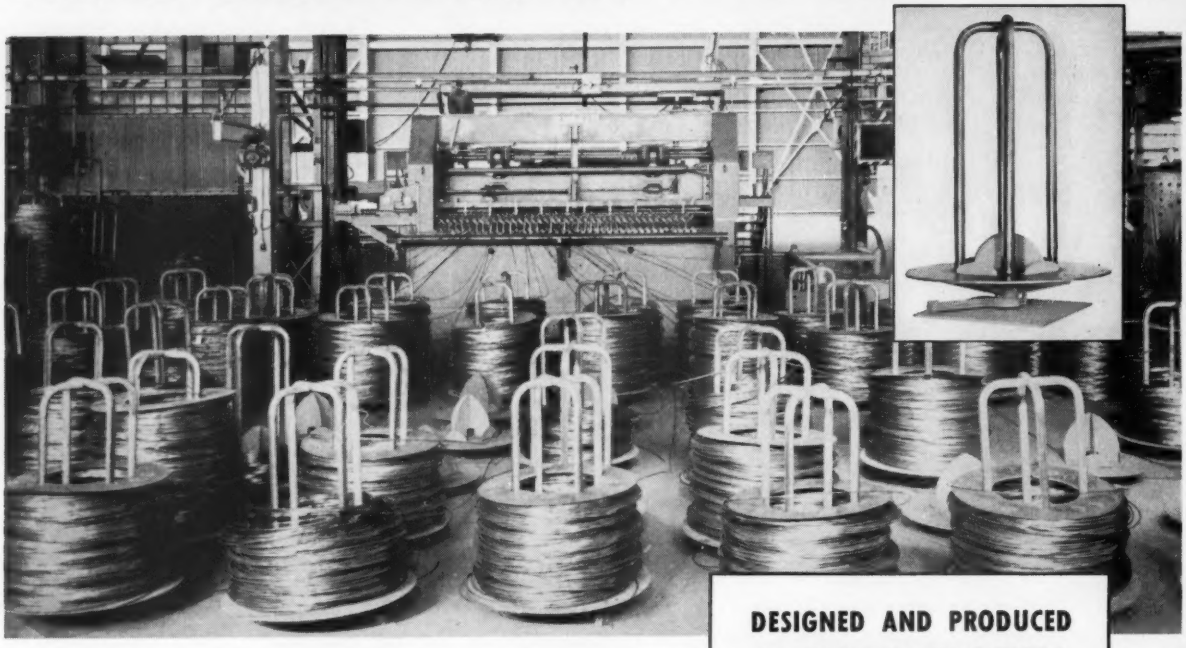
WORKING WONDERS WITH WIRE: **UP** goes production efficiency, **DOWN** go losses at Detroit Steel Corporation

...thanks to Northern Indiana Steel's high capacity, heavy-duty WIRE CARRIERS and PAY-OFF REELS



WIRE DRAWING—DETROIT STEEL STYLE

Behind-the-scenes at the recently-installed welded wire fabric machine, which draws wire for the widely-known LPR Coils at Detroit Steel Corporation's Portsmouth, Ohio Plant. You see the entry side of the giant machine, with Northern Indiana Steel Wire Carriers and Pay-Off Reels in use for both feeding and storaging wire to the unit. In this way interruption is reduced to a minimum.

"MAKES LONG PRODUCTION RUNS POSSIBLE,"

says Detroit Steel's Rod and Wire Division head:

Reports Superintendent U. V. Johnson, "The introduction of these wire carriers and pay-off reels as part of our handling equipment has greatly improved the efficiency of our wire drawing and welded fabric operations. It makes long production runs possible in wire-making and wire-users plants."

DESIGNED AND PRODUCED TO YOUR SPECIFICATIONS

Wire Carriers and Reels that

- ✓ **FEED MORE SMOOTHLY**
- ✓ **CARRY UP TO 4,000 LBS.**
- ✓ **STACK AND STORE EASILY**

Let us know exactly what your operating needs require. If we don't already have it in stock, we're ready to make up your order as per your specifications. In any case, we'll be pleased to quote you promptly in quantities specified.

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Fabricating Division, Michigan City, Indiana

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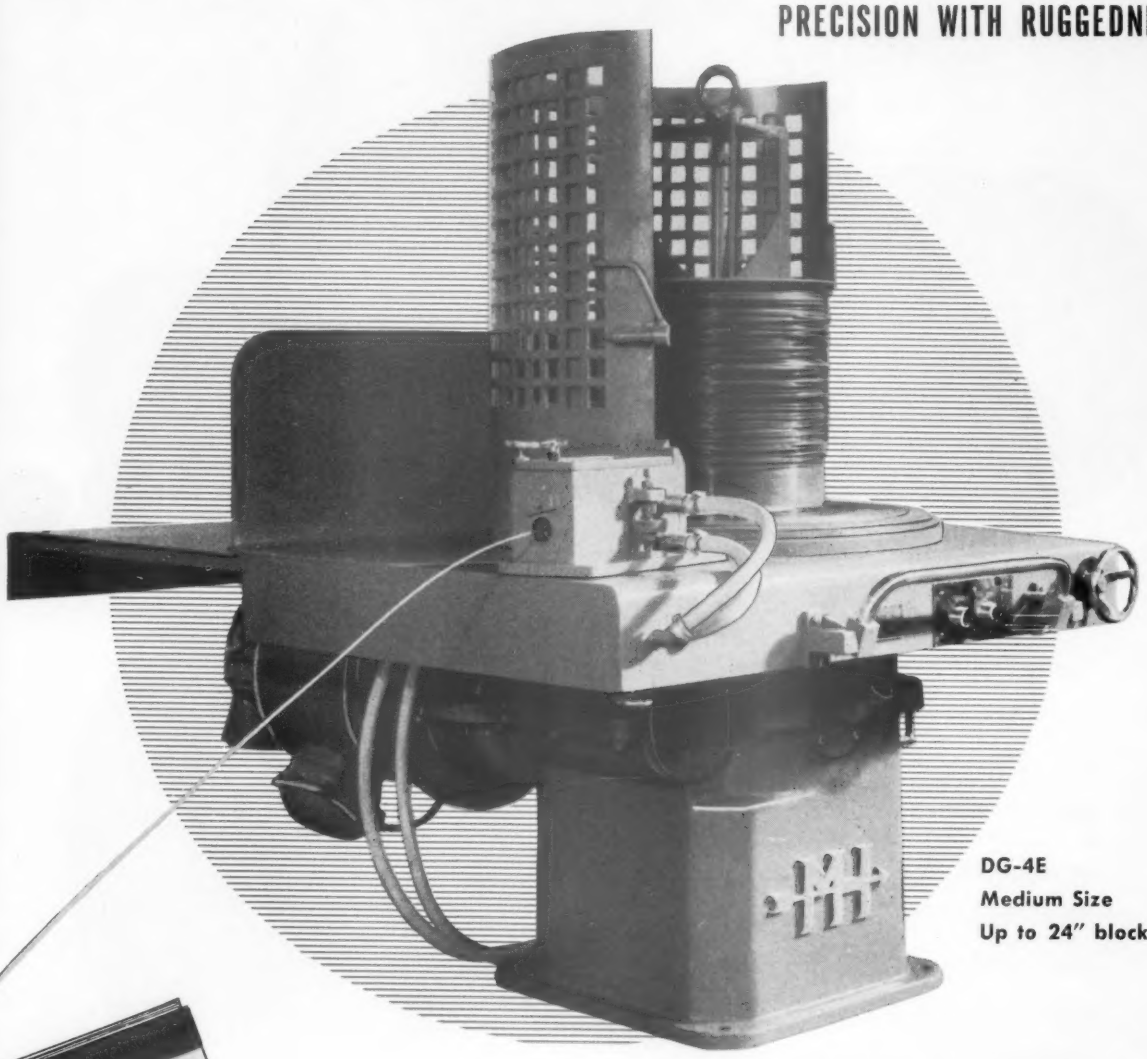
SINGLE or DOUBLE DECKED

PRECISION WITH RUGGEDNESS



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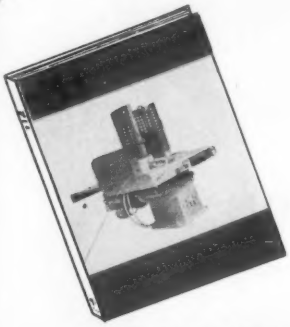

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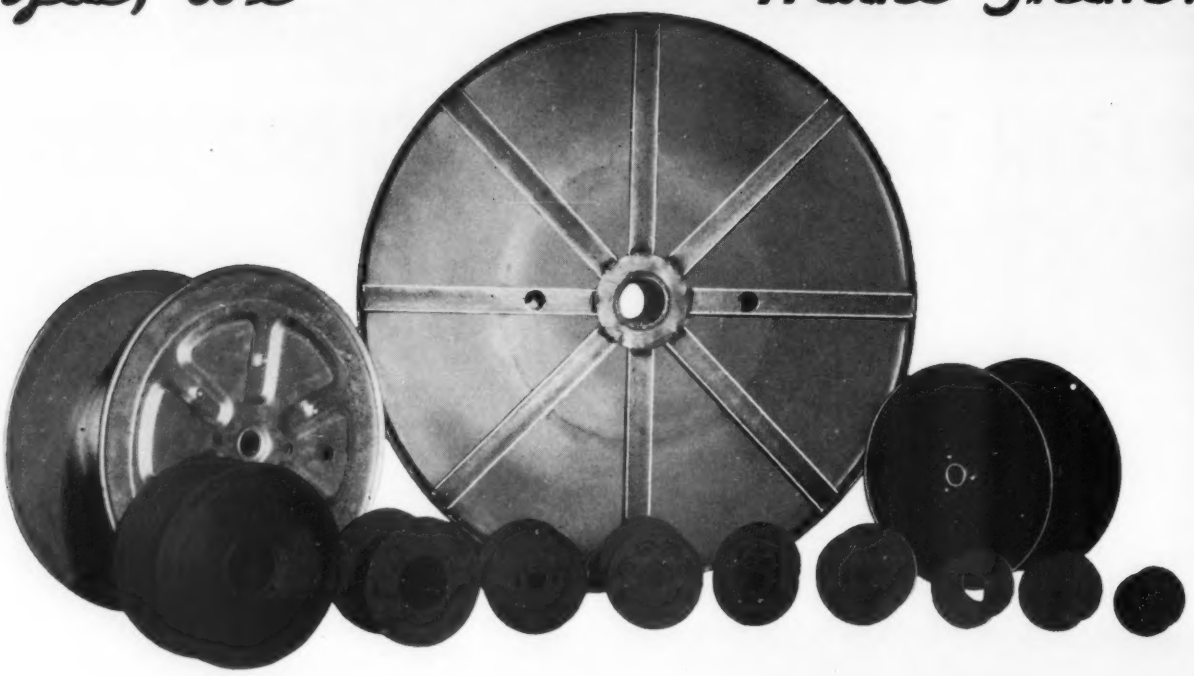

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The Wire Outlook

Those who hold that recovery is spotty or faltering are not being supported by the facts. Business is not only satisfactory on a broadened base but is becoming stronger.

Steel production continues to climb and stands at about 94% of capacity. Personal income in February was $1\frac{1}{2}$ billion over January, the greatest increase being in payrolls, which rose $750 million. Hourly pay rates in factories have not changed for several months, averaging $2.19 per hour or about $87 per week. In the metal industry, wages are $16 a week higher than a year ago. Steel industry wages are a little over $2.78 per hour on a straight time basis, but in 1958 actually averaged $3.51 per hour worked, because of Sunday, holiday and overtime premium pay. This represents an increase in 1958 over 1957 of 9.2 per cent, during which time living costs rose 3 per cent.

There is talk about the possibility of a steel strike in July. If one is called, the steel companies and their workers will be the ones principally affected, since there will be plenty of steel in the warehouses to tide over buyers. Unfortunately, strikes usually end with at least a partial granting of demands and this is expected to be no exception.

This raises the question as to how far our economy can be stretched by the inflationary effect of wage increases before it collapses into a corrective depression. Labor's wages already are so far out of line with those paid elsewhere in the world that the disparity is being felt in growing volumes of imports to an alarming degree in the wire industry, Steelworker's President McDonald to the contrary. He is reported to have said that if labor worked for nothing, our producers would still suffer from foreign competition, because of our antiquated equipment and processes. He should know better.

The pressure of constantly spiraling costs induced by wage grants must eventuate in a day of reckoning. When it comes, even if not for several years, it will be severe—perhaps "devastating" is the better word.

A point will come, unless labor pauses in its ever-increasing demands to allow the rest of the world to catch up with us, when the whole fabric of the economy must topple. At that time citizens are going to have to face tough times, perhaps worse than those following the 1929 crash. It is just a question of what new feather-bedding regulation or which new wage increment will be "the straw that breaks the camel's back."

And let's not forget, too, that governmental fiscal policies are contributing to the groundwork of trouble ahead. Ancient Rome followed the same royal road to ruin. The Congress is deficit-spending minded. Farm price supports, inordinate "veteran" benefits, TVA-type projects, playing Santa Claus to the world, and innumerable other ways of wasting our substance will all contribute to the days of breadlines and suffering. Too bad there are not more public servants in Washington of the calibre and courage of Senator Byrd!

The construction industry is a leader in the present boom, with home building the strongest element in this phase of industry. Outlays for new plants in 1959 will total $33 billion, which will be about 4 per cent higher than last year.

Corporate profits appear to be headed for satisfactory highs this year. They were $36.4 billion in 1958 and it is estimated that 1959 will show profits of $44 billion. Our best year was in 1956, when such earnings were $45.5 billion. All these figures are before taxes.

Wire mills are reporting that orders are coming in at a better rate than for many a long day. Some are entering more business on their books for manufacturers' wire than can be processed promptly.

Other factors that are helping the wire industry are the seasonal increase in demand for welded reinforcing fabrics and for merchant wire products. Wire mills in general are said to be operating at around 90% of capacity, partly due to the foregoing and as a hedge against the possibility of strikes and higher prices.

Profits are a good and normal expectation of management. Operations have to show up in the "black" in order to provide jobs. A breathing spell in wage demands would be tremendously helpful to business and the nation.

For the next three or four years the signs are favorable.

Edmund Duval Sickels
EDITOR

STEELSKIN

#120

Ten years ago we developed this fused metallic-stearate lubricant containing extreme pressure ingredients for the drawing of stainless steel wire. Today it is one of our more popular lubricants in stainless and carbon steel wire-drawing mills throughout the nation. "STEELSKIN" #120 Powder has the property of picking up and forming a strong, heavy lubricant coating on the first pass.

Customers report drawing stainless as many as five holes without annealing and recoating. When used in drawing lime coated stainless steel, "STEELSKIN" #120 has eliminated the need for lead coating. It is compatible with either lime or borax-type coatings on carbon steels.

If you are *not* using "STEELSKIN" #120 in the drawing of rope wire . . . oil-tempered wire . . . music wire . . . tire-bead wire . . . valve-spring wire . . . stainless cold-heading wire, and nickel-chromium alloys, contact us for further information, today.

A SPECIAL USE: "STEELSKIN" #120 is now being used for drawing descaled rod to chain-link fence and welded fabric wire. Although #120 is a metallic soap, it produces a slightly cleaner finish which effects good welds and prevents undue fouling of the electrodes.

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WIRE
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A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 34 MAY, 1959 No. 5

Measurements of Temperature in Wire Drawing with a Wire Drawing Die Thermocouple Using a Hard Metal Ball Core

by

Dipl.-Eng. Rudolph Brühl, Manager
Plettenberger Drahtindustrie GmbH
Wire Mill of Gebr. Stumm GmbH
Neunkirchen, Saar, Germany

An interesting study made in the long-continued effort to measure the temperatures developed in a wire drawing die under production conditions.

Many different attempts have been made to determine the temperatures in wire drawing, but they were mostly carried out at drawing speeds which, in practice, are of no account.

★ ★ ★

For this reason it is still interesting to get information about the temperatures arising in the wire drawing die when wire is drawn.

The problem was to create a device, with the aid of which, the actual temperatures in the usual drawing process, in practice, at normal drawing speeds can be stated.

★ ★ ★

This possibility was provided by the application of a hard metal ball type core. The test required an easy access to the point of contact of the wire and the drawing die, a perfect cooling of the drawing die, and good sealing of the cooling water.

★ ★ ★

As shown on Figs. 1 and 2 the ball core came up to these requirements.

FIG. 1

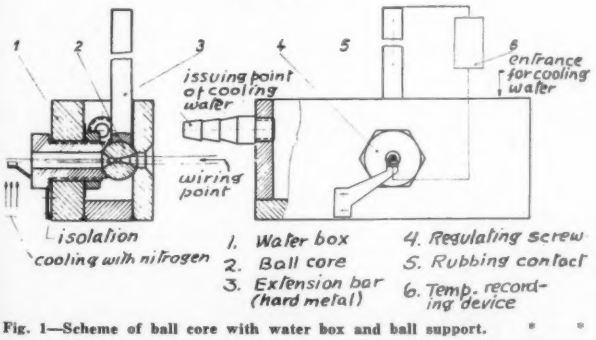


Fig. 1—Scheme of ball core with water box and ball support.

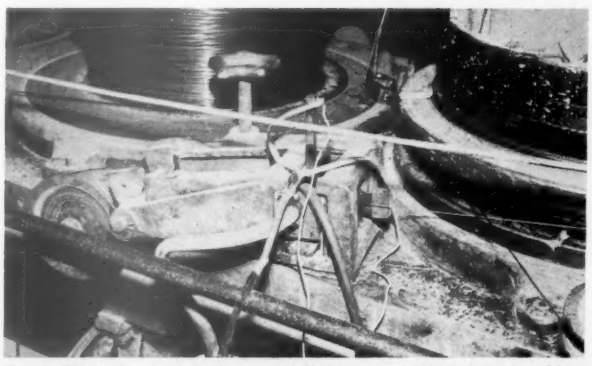


Fig. 2—Water box with ball core installed in a multiple drawing machine.

The water box (1) was open at the top so that the cooling water level could be checked at any time.

★ ★ ★

By means of a regulating screw (4) the ball core (2) was firmly screwed down to the side at which the wire entered the machine. By this means, a good sealing of the cooling water to the soap box was obtained.

★ ★ ★

The wire formed one side of the thermocouple while the ball core (2) of hard metal G 1 (dia. of ball core 17mm) together with an extension bar of about 130 mm length formed the other side.

★ ★ ★

The contact-zone of wire and wall of the drawing die served as a hot end.

★ ★ ★

The cold ends were the connection at the hard metal bar (3), and the tapping point of the rubbing contact (5) at the wire running through.

★ ★ ★

Both points of contact were cooled by nitrogen by means of a pipe. The high expansion of the nitrogen provided a good heat emission and a constant temperature at the points of contact of the thermocouple.

★ ★ ★

The water box with ball core and thermocouple was isolatedly installed in the plate box holder. The wire die type thermocouple was adjusted at a temperature recording device before being built in.

★ ★ ★

Furthermore, it was possible to trace the surface of the ball core with a calipering pyrometer during the drawing process and to find out the temperatures at the surface of the ball core at the same time.

★ ★ ★

In Fig. 2 the two points of contact of the thermocouple, their cooling device, and the leads to the recording device, which will be shown separately on Fig. 3, are distinctly to be seen.

1st Measurement of Temperatures

A multiple drawing machine

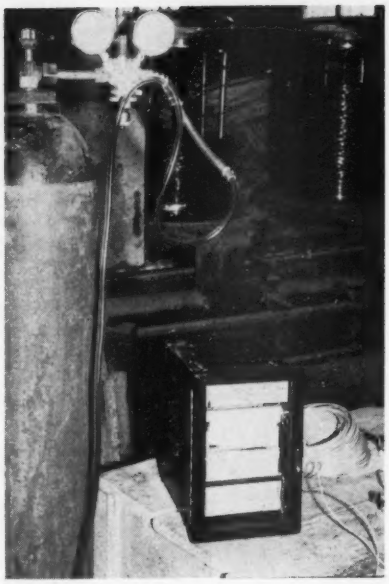


Fig. 3—Recording device and nitrogen bottle for cooling the points of contact.

with 6 drawing blocks at speeds of 8 and 10 m/ sec. was applicated.

★ ★ ★

The wire was drawn in 6 passages from 5.5 mm Thomas rod wire to a diameter of 2.0 mm. A normal soap served as lubricant.

★ ★ ★

During 5 passages the draw plates were cooled indirectly, and only during the last process the ball core was cooled directly. Temperature was measured during the last passage from 2.23 to 2.0 mm with a reduction of the cross-sectional area of 26%. The approach angle of the ball core was 16°, and the cylindrical length 0.5 x D.

★ ★ ★

The result of this test is shown on Fig. 4.

★ ★ ★

The indicated temperatures of the thermo-voltage records at a drawing speed of 8 m/sec. were near 320°C, and near 370°C at 10 m/sec., in the draw plate box.

★ ★ ★

The cooling water temperature was between 20 - 30° C.

★ ★ ★

The temperature at the surface of the ball core was between 170 - 180° C with water cooling. Without water cooling the ball core immediately took the temperature of the wire surface of 320 or 370° C, respectively.

★ ★ ★

During the drawing process rising vesicles could be observed at the ball surface which proved that the outside temperature of the ball made the water boil.

★ ★ ★

A rough calculation of the distribution of temperature between the drawing die and wire, according to **E. Siebel** and **R. Kobitsch** in "Stahl und Eisen 63" (1943) pages 110/113, was made in this test.

a) Calefaction by deformation:

$$t_1 = \frac{Sn \cdot kf_m}{A \cdot c \cdot \gamma}$$

S_n = deformation of the wire $= \ln \frac{F_o}{F_1} = \ln \frac{0.233^2}{0.198^2} = 0.322$

k_{fm} = average deformation resistance for Thomas quality = 5000 — 6000 kg/cm²

A = mechanic thermal equivalent = 42700 cm kg/kcal

c = specific heat = 0.115 kcal/kg °C

γ = specific weight = 7.8 10^{-3} kg/cm³

$$t_1 = \frac{0.322 \cdot 5500}{42700 \cdot 0.115 \cdot 7.8\ 10^{-3}} = 46°\ C$$

b) Calefaction by friction:

$$t_2 = 1.22\ m \frac{\mu \cdot {}^{k}fm}{A} \cdot \sqrt{\frac{1 \cdot v}{\lambda \cdot c \cdot \gamma}}$$

m = factor of heat taken up by the wire = 0.8

μ = friction factor = 0.05

1 = length of wire layout = 0.3 mm

v = drawing speed = 800 or 1000 cm/sec., respectively

λ = caloric conductibility = 0.125 10^{-3} kcal/cm sec °C

$$t_2 = 1.22 \cdot 0.8 \frac{0.05 \cdot 5500}{42700} \cdot \sqrt{\frac{0.3 \cdot 800 \text{ or } 1000}{0.125 \cdot 10^{-3} \cdot 0.115 \cdot 7.8\ 10^{-3}}} = 289 \text{ or } 324°\ C$$

$t_1 + t_2 = 298 + 46 = 335°$ C at 8 m/sec

$= 324 + 46 = 370°$ C at 10 m/sec

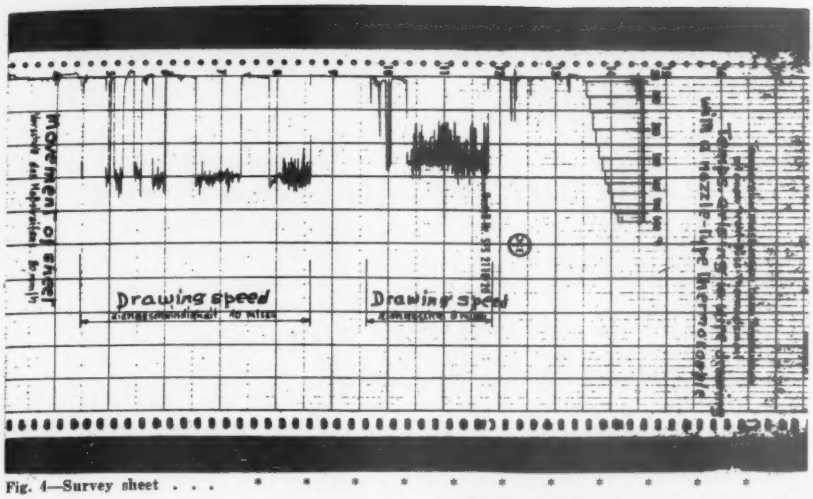


Fig. 4—Survey sheet . . .

The results are of about the same order as the temperature degrees calculated in the drawing process.

2nd Measurement of Temperatures

Now a multiple drawing machine with 4 draw blocks, at drawing speeds of 3.5 and 5 m/sec. was applicated.

★ ★ ★

The wire was drawn in 4 passages from 5.5 mm Thomas rod wire to a final diameter of 2.5 mm. The rod wire was descaled mechanically by means of a roller bending apparatus. A stearate served as lubricant.

★ ★ ★

The draw plates were cooled indirectly, and only during the last passage was the ball core cooled directly.

★ ★ ★

Temperature was measured during the last passage from 2.98 to 2.5 mm with a draught of 29.5%. The approach angle of the ball core now was 20°, the cylindrical length also 0.5 x D.

★ ★ ★

The result of this test is shown on Fig. 5.

★ ★ ★

The indicated temperatures of the thermo voltage records, at a drawing speed of 3.5 m/sec. are on the average near 225°, and at 5 m/ sec. near 270°C.

★ ★ ★

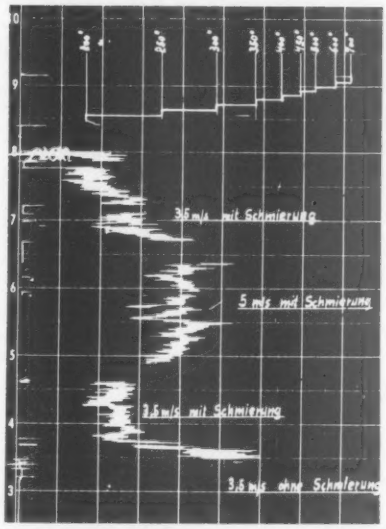


Fig. 5—Survey sheet . . .
Ohne schmierung—without lubrication
Mit schmierung—with lubrication

At a speed of 3.5 m/sec. but without lubrication of the wire the temperature rose over 300° C. In both cases the cooling water temperature in the draw plate box was near 14° C. The surface temperature of the ball core with water cooling was near 45° C at 3.5 m/sec., and near 62° C at a speed of 5 m/sec.

3rd Measurement of Temperatures

In this test a multiple drawing machine with 5 draw blocks and a final drawing speed of 3.25 m/sec. was applicated.

★ ★ ★

Patented steel wires of different tempers were drawn. A normal soap served as lubricant.

★ ★ ★

As in the former tests the draw plates were cooled indirectly, and the ball core was cooled directly.

★ ★ ★

In both tempers the draught was about 30%.

★ ★ ★

In both cases the approach angle was 12°, the cylindrical length 0.70 x D.

★ ★ ★

The analysis and the technological nature of both steel wires were as follows:

Steel a)

Diameter of manufactured wire: 1.45 mm
Resistance: 121 kg/mm²
Bendings: 25 (dia. of bending cyl. 10 mm)
Torsions: 19

Analysis:	C	Si	Mn	P	S
	0.34	0.20	0.50	0.032	0.022

Steel b)

Diameter of manufactured wire: 1.45 mm
Resistance: 170 kg/mm²
Bendings: 24 (dia. of bending cyl. 10 mm)
Torsions: 15

Analysis:	C	Si	Mn	P	S
	0.58	0.21	0.54	0.03	0.024

★ ★ ★

The results of this test are shown on Fig. 6.

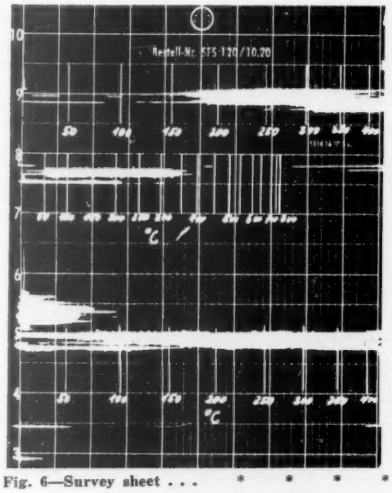
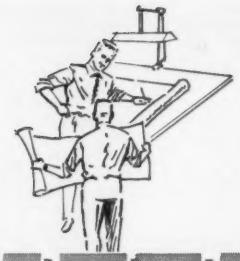


Fig. 6—Survey sheet . . .

The indicated maximum temperatures of the thermo voltage records were between 210 and 350° C, and the cooling water temperature in the draw plate box near 19° C in the case of steel a). The surface temperature of the ball

(*Please turn to page* 634)

Because of Research...



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A complete line of lightweight, precision shipping and processing spools (both steel and aluminum) known for great strength, long life and dynamic balance.

Acrometal's "corporate image" today is really TWO things:
(1st) We are the leading designer and manufacturer of reels and spools, either returnable or non-returnable.
(2nd) We design and build special machinery to meet special problems of the wire industry.

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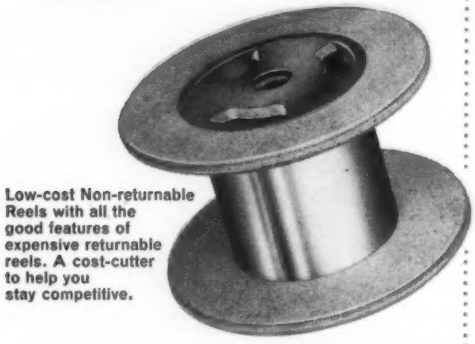
We make a lot of things besides spools. Most of our special equipment was designed because somebody came to us with a problem. We have the imagination . . . the research facilities . . . and the engineering experience to design, make, and perfect special devices for special uses. Maybe we can help you, too.



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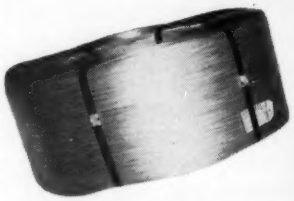
Special equipment for handling big reels and coils of wire. Lifts, tilts, and turns heavy loads easily!



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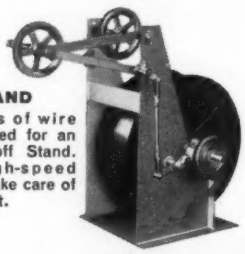
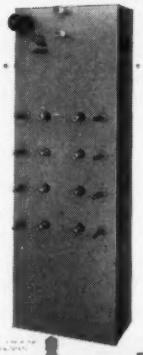


LET-OFF STAND

Big packages of wire created the need for an improved Let-off Stand. We offer high-speed equipment to take care of any requirement.



Multiple Spindle Spoolers for precision spooling of either fine or heavy wire. Compact design to conserve floor space. Model shown occupies only 2 sq. ft. of floor space.

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Electrical Resistance Characteristics of Polyvinyl Chloride Formulations

by

Mansfield Williams
Asst. Mgr., Technical Service
Opalon Vinyl Resins & Compounds

and

J. R. Taylor
Physicist
Research Department

Plastics Division
Monsanto Chemical Company
Springfield, Massachusetts

This paper was presented at the National Conference on the Application of Electrical Insulation in Cleveland, Ohio, on September 5, 1958.

A fundamental relation exists between the volume resistivity or specific resistance and the insulation resistance of a dielectric material. This relation may be used to predict the insulation resistance of an electrical insulating material in a given construction from the measured volume resistivity of the material. The prediction must take into account the geometry and dimensions of the construction and the measuring parameters; namely: (a) voltage gradient, (b) electrification time, and (c) test temperature. The effects of the measuring parameters, specimen preparation, and measuring circuit on volume resistivity are discussed. Experimental data, corrected for measuring parameters, show a correlation between the volume resisticity of a vinyl compound and its insulation resistance as a wire covering.

Introduction

The primary characteristic of an electrical insulation is its resistance to the flow of an electrical current. This enables transmission of current through an electrical conductor with low current losses to its surroundings. Consequently, definition and measurement of the electrical resistance characteristics of the insulation assume basic importance.

★ ★ ★

The relationship of the volume resistivity, of the insulating material to the electrical resistance offered to passage of a current between electrodes applied to parallel faces of the sample is given by the expression:

$$\rho = R_v \frac{A}{t}$$

where:

ρ = volume resistivity, ohm-cms
R_v = volume resistance, ohms
A = cross sectional area, cm.^{2}
t = thickness, cm.

★ ★ ★

The insulation resistance of a concentric insulation around a single conductor of length L is similarly related to the volume resistivity of the insulation, and may be expressed as:

$$R_I = \frac{\rho}{2\pi L} \ln \frac{D}{d}$$

where:

R_I = insulation resistance, ohms
L = length of cable, cm.
ln = logarithm, base "e"
D = outside diameter of insulation, cm.
d = inside diameter of insulation or diameter of conductor, cm.

★ ★ ★

The insulation resistance, R_I, is commonly expressed in terms of the resistance for a 1000 ft. cable length or "megohms per 1000 feet," and specification requirements are usually in these terms.

★ ★ ★

In the case of a specific wire construction, such as 1000 feet of a #14 solid AWG conductor with 2/64" insulation, the relationship becomes:

$$R_I = \frac{\rho}{2.76 \times 10^{11}}$$

where:

R_I = insulation resistance, megohms per 1000 ft.

★ ★ ★

A typical insulation resistance value for such a construction insulated with an electrical grade plasticized PVC compound would be 2050 megohms per 1000 feet at 15.6°C. This would correspond to a volume resistivity of 5.66 x 10^{14} ohm-cms., or to a "K" value of 6810 in the relation:

$$R_I = K \log 10 \frac{D}{d}$$

where:

K = resistance constant, megohms per 1000 ft.

★ ★ ★

While it is general practice to consider insulation resistance values obtained directly from specific cable constructions as having the most significance, frequently it is desirable to take advantage of the direct relationship between insulation resistance and volume resistivity. This is true particularly where a laboratory wishes to determine the electrical resistance characteristics of small samples of a vinyl compound for development or control purposes.

★ ★ ★

Two techniques found of value for such characterizations are:

a. Volume resistivity measurement, according to ASTM D-257.
b. The molded-electrode test developed by Monsanto Chemical Company (Organics Chemical Division)[1]. This test enables insulation resistance measurements to be made on molded

test slabs immersed in water; test pieces can also be adapted to other electrical tests such as Specific Inductive Capacitance (SIC) and SIC change on water immersion.

1 "The Testing of Polyvinyl Chloride Electrical Formulations" by G. W. Ashworth, J. R. Darby, W. E. Koerner, and R. H. Munch; ASTM Bulletin, May, 1957.

Volume Resistivity

The accuracy with which the volume resistivity of PVC insulation materials can be determined is dependent on many factors. With the use of suitable test equipment and careful control over such potential variables as temperature, voltage gradient, electrification time, sample preparation, etc., reproducibility of results to within ±3% has been shown in carefully replicated experiments.

★ ★ ★

A test program was initiated to determine the effect of temperature, specimen preparation, voltage gradient and electrification time on the volume resistivity of PVC compounds. Measurements were made at three temperatures (50°C, 60°C, and 70°C) using a vacuum tube electrometer and a regulated direct voltage supply. The test specimen surfaces were prepared with conductive coatings (silver paint and colloidal graphite) and metal foil (tin and lead). Specimens without conductive surfaces were tested in a specially designed sample holder for comparison purposes.

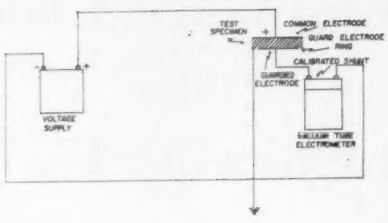
★ ★ ★

The specimens prepared with the conductive coatings and those without prepared surfaces were measured using a guarded electrode (Fig. 1A). The specimens with foil as the conductive surfaces were measured using an unguarded electrode (Fig. 1B).

★ ★ ★

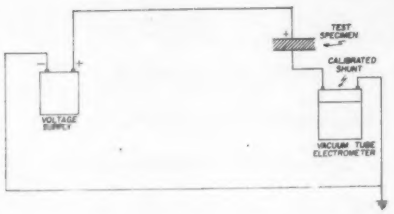
The effect of voltage gradient on the volume resistivity was shown by maintaining the regulated supply voltage constant and varying the thickness of the test specimens. The direct voltage was maintained at 250. The specimen thicknesses used were 0.025, 0.050, and 0.125 inches which gave respectively voltage gradients of the following magnitude: 10 volts/mil, 5 volts/mil, and 2 volts/mil. The effect of electrification time was

FIGURE 1-A



CIRCUIT USED FOR THREE TERMINAL MEASUREMENTS

FIGURE 1-B



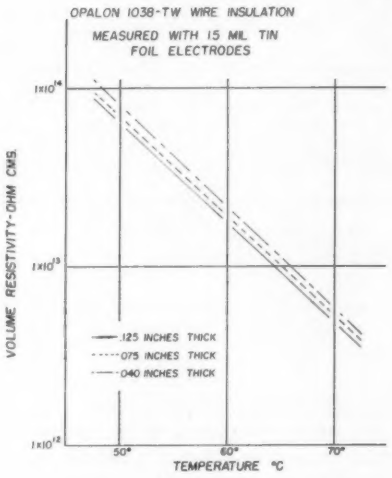
CIRCUIT USED FOR TWO TERMINAL MEASUREMENTS

studied in conjunction with the voltage gradient tests.

★ ★ ★

The following conclusions were reached from the experimental data:

FIGURE II

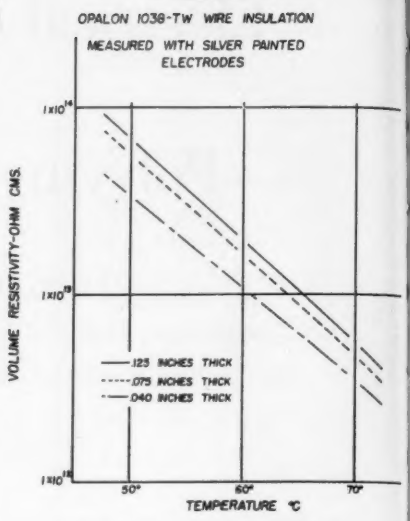


TEMPERATURE VS VOLUME RESISTIVITY

a. **The volume resistivity decreased with increasing temperature (see Figures II, III, IV and V). The slope of the curve was dependent on the compound being measured.**

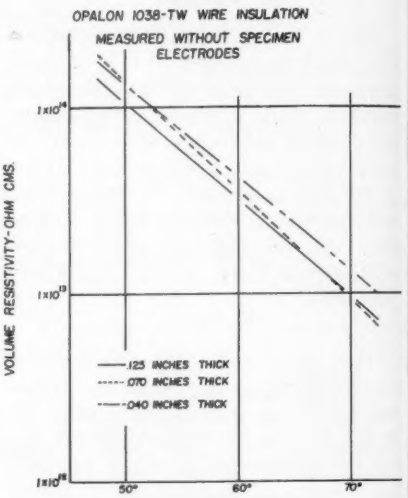
b. **The foil surface electrodes gave the most consistent results (see Figures II, III, and IV). The conductive silver lacquer attacked the PVC plasticizer causing solvent and silver pigment migration of the conductive lacquer into the volume of the test specimen. The migration decreased the insulating volume and introduced error into the measurements of volume resistivity. As would be expected, the error increased with decreasing thickness (see Figure III). The coating of colloidal graphite was very brittle when dry and tended to crack making specimens coated with graphite difficult to measure.**

FIGURE III



TEMPERATURE VS VOLUME RESISTIVITY

FIGURE IV



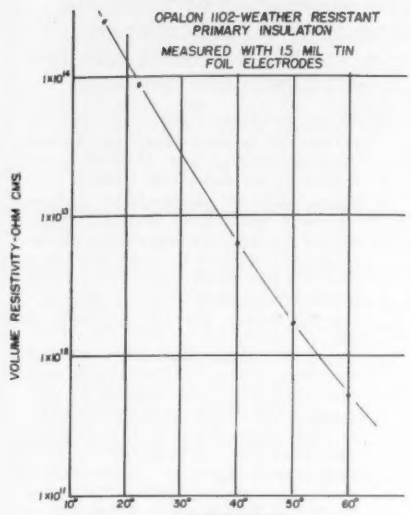
TEMPERATURE VS VOLUME RESISTIVITY

c. **Specimens measured without prepared surfaces had volume resistivities approximately twice as high as those specimens with conductive surfaces (see Figures III and IV—0.125 in thickness).**

d. **Comparisons of volume resistivity values obtained using guarded and unguarded measuring electrodes showed the edge leakage currents of the unguarded system to cause negligible error. The comparisons were made using specimens 0.125 inches in thickness (see Figures II and III).**

e. **Volume resistivity increased with an increase in electrification time for a specified voltage gradiant.**

FIGURE V

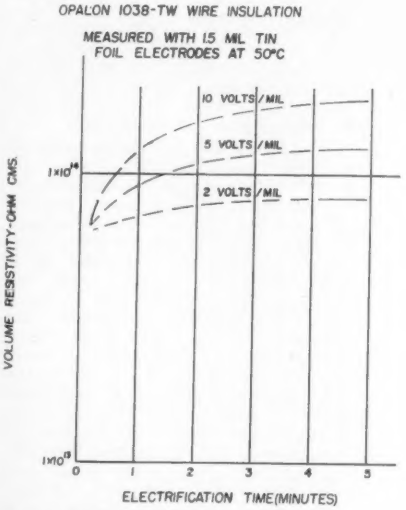

OPALON 1102-WEATHER RESISTANT PRIMARY INSULATION
MEASURED WITH 1.5 MIL TIN FOIL ELECTRODES
VOLUME RESISTIVITY-OHM CMS.
TEMPERATURE °C

TEMPERATURE VS VOLUME RESISTIVITY

The greatest rate of change occurring the first two minutes (see Figure VI).

f. Volume resistivity increased with increasing voltage gradient for a specified electrification time in the range between two volts per mil and 10 volts per mil (see Figure VII).

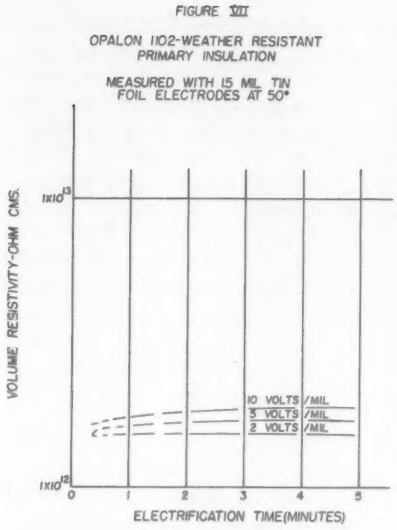
FIGURE VI



VOLUME RESISTIVITY VS ELECTRIFICATION TIME

Temperature may be considered the most important factor affecting resistivity measurements. The volume resistivity of PVC compounds decreases rapidly as temperature increases, as shown by Figures II, III, IV and V. As a specific example, the volume resistivity of Opalon 1038 at room temperature is almost two decades higher than at 60°C.

FIGURE VII



VOLUME RESISTIVITY VS ELECTRIFICATION TIME

As a result, close control of the temperature at which a PVC insulation is tested is essential. A variation of only 1.0°C from a specified temperature can cause an error in the resistivity determination in the order of 10%. Elevated test temperatures obtained by use of suitably controlled ovens offer two advantages:

a. Closer control of the testing and sample conditioning temperature than may be afforded by the normal "room temperature" environment.

b. Better test precision may be possible at elevated temperature in cases where the high level of volume resistivity of some PVC insulation materials at room temperature approach or surpass limitations of the measuring instrument.

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A convenient standard temperature used by a number of laboratories is 50°C ± 0.25°C.

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Voltage gradient and electrification time, although not considered as important as temperature on volume resistivity variations, are nevertheless important factors in obtaining consistent results. An appropriate electrification time for PVC wire compounds appears to be two minutes. While this does not correspond to the conventional electrification time of one minute. it should be noted that ASTM D-257 recommends selection of a suitable time of electrification on the basis of a volume resistivity vs. time curve when the one minute electrification time might produce misleading results. Considering the factors presented above, volume resistivity data presented herein was obtained as follows unless otherwise indicated: (1) measuring temperature 50 ± 0.25°C, (2) foil surface electrodes, (3) electrification time of two minutes, (4) unguarded electrode system, and (5) a voltage gradient of five volts per mil (specimen thickness of 50 mils and a voltage stress of 250). The measuring circuit used was that shown for two terminals measurement in Figure 1B.

Determination of Insulation Resistance Using Volume Resistivity

The mathematical relationship between volume resistivity and insulation resistance was expressed previously. To explore what could be termed the "practical relationship" of these quantities, the following experiment was performed.

★ ★ ★

Four samples of Opalon 1102 were prepared, each sample representing differing batches of raw materials. Each sample was used to insulate #24 AWG solid conductor with 0.0225 inches insulation under closely controlled extrusion conditions. In addition, 5" x 5" x 0.050" slabs were compression molded from the material extruded.

★ ★ ★

Volume resistivity measurements were made at 50°C on samples prepared with .0015" tin foil electrodes. Insulation resistance measurements were made on separate coils of wire 55 feet in length (50 feet immersed) at a temperature 15.6°C, after 16 hours of immersion in water. All measurements were made on duplicate test specimens (averaging results) using a vacuum tube electrometer, and associated equipment. Samples were tested at equivalent lengths of time after preparation to avoid a possible test variable. The insulation resistance of the wire coating was determined after two minutes electrification with 100 volts applied.

★ ★ ★

To compare the resulting volume resistivity and insulation resist-

ance measurements to each other directly, it is necessary to translate one into units of the other, and while so doing to convert the data to a common basis with respect to temperature, voltage gradient, and electrification time.

★ ★ ★

To translate the V.R. (ohm-cm) data taken at 50°C to terms of I.R. (megohms per 1000′) at 15.6°C, it was necessary to have the following conversion factors:

a. **The volume resistivity of Opalon 1102 is 150 times greater at 15.6 than at 50°C.**

b. **The volume resistivity of a specimen was determined with a voltage gradient of 2 volts per mil and the insulation resistance determined with 4.4 volts per mil. To compensate for the difference in voltage gradient, the volume resistivity was multiplied by 1.05.**

c. **$R_I = \rho \times 6.15 \times 10^{-6}$ (where R_I and ρ have been put on common test basis)**

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Employing these relationships, and converting the V.R. data obtained at 50°C to calculated I.R.'s at 15.6°C, yielded the results shown in Table I

TABLE I

Sample	V.R. at 50° C ohm-cm	Actual I.R. at 15.6°C Megohms/1000′	Calc. I.R. (from V.R.) at 15.6°C Megohms/1000′	Mean Deviation Megohms/1000′
A	1.20×10^{12}	1400	1160	240
B	1.87×10^{12}	1500	1810	310
C	2.02×10^{12}	1925	1960	35
D	2.40×10^{12}	2078	2320	242
		1726	1812	±207

The agreement between the average of the calculated I.R.'s and the actual measurements is good, with an average deviation in individual measurements of about 12%.

★ ★ ★

As pointed out previously, the measurement of V.R.'s at an elevated temperature, is often preferable to room temperature measurement from the standpoint of test precision. Volume resistivity data obtained at a known temperature may be converted to insulation resistance at any desired temperature provided the resistance temperature correction factors and the polarization characteristics are known for the insulating material.

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In comparing I.R. values which are calculated from V.R. data with actual I.R. values obtained on samples immersed in water, the effects of continued immersion on the electrical resistance characteristics cannot be ignored. However, under the conditions of this particular experiment, the effects of 16 hours immersion at 15.6°C seem to have been relatively slight. This may be due in part to the moderate water temperature and length of immersion, and also to the good moisture resistance properties of the compound.

★ ★ ★

Insulation resistance measurements were made on several lengths of #24 AWG wire coated with Opalon 1102, at specified intervals over a 48 hour period while immersed in 15.6°C water. The average decrease in insulation resistance, determined using the values obtained at the beginning and end of the test, was 13%. The greatest change took place in the first 10 hours of immersion.

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Immersion at a higher temperature could be expected to produce a greater effect, however.

★ ★ ★

An additional factor of possible interest in the comparison of V.R. and I.R. data in this experiment would be the difference between the foil/PVC interface used in the V.R. test and the copper/PVC interface in the I.R. test. However, previous work by others[2] has not indicated that this need be considered a significant factor.

★ ★ ★

The relatively good agreement between the insulation resistance values calculated from the volume resistivity data and the actual insulation resistance measurements shown in the preceding table will not necessarily be found under other experimental conditions. Factors which have significant effect, and must be considered, are:

a. **Those relating directly to the accuracy of measurement of the volume resistivity (or insulation resistance) as described earlier.**

b. **Temperature correction factors. The key role these play was illustrated by the magnitude of the multiple which was used to convert V.R. measurements at 50°C to their equivalents at 15.6°C — the 50°C measurement was multiplied by 150.**
It is essential that accurate temperature correction factors be used.

c. **Differences in the degree of processing in sample preparation—excessive heat history, for example, can have an unfavorable effect on electrical properties. Differences in resistance properties have also been observed which were dependent on the length of time between sample preparation and testing.**

2 **"Measurement of Volume Resistivity of Plasticized Polyvinyl Chloride" by E. E. Balmer and R. G. Coyne. Presented at the "Wire and Cable Symposium" at Asbury Park, New Jersey, in 1956.**

d. **Since insulation resistance values of PVC insulation change progressively on continued water immersion, the correlation will be adversely affected by increasing the time of the immersion. The effects of immersion at a given temperature on a specific PVC formulation must be quantitatively determined as a function of time to effectively relate V.R. and short term (circa 1 day) I.R. data. Where immersion effects are appreciable, the use of the molded electrode test previously mentioned may be indicated.**

e. **Not infrequently, a close relationship has been found between V.R. data and an I.R. measurement obtained on short (50 foot) lengths of insulated wire. However, longer lengths (i.e., full reel lengths) from which the 50 foot samples were taken may show much lower insulation resistance values. In cases where low insulation resistance was investigated, partial flaws were found to be responsible. These partial flaws were caused by cracks or foreign contamination which did not fail under proof test voltages. However, such partial flaws cause the lower I.R. by permitting the passage of appreciably more current than the surrounding insulation. Since only a small number of such flaws are required to lower the insulation resistance of 15,000 feet of wire by half a decade or more, there is a good chance that a 50 foot oil from this same reel will have no flaws and consequently an appreciably higher I.R.**

★ ★ ★

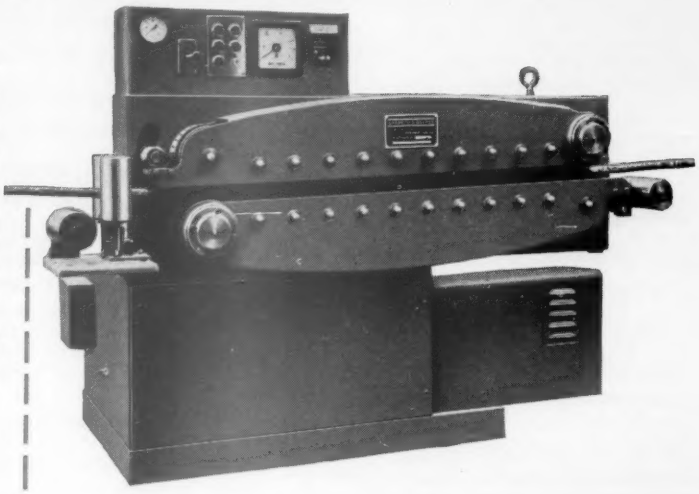
Additional work has been planned by this laboratory to further investigate these factors and their quantitative effects on the rela-

(*Please turn to page* 628)

NEW MACHINES

Larmuth & Bulmer of England have been manufacturing rope and cable-making machinery for more than half a century. During this time their skill and experience have produced high quality machines which are used throughout the world today.

Now this craftsmanship has been combined with the production resources of a group of British Engineering Companies to provide a spares and delivery service in keeping with the high standard of their machines. Coupled with this service is the recognition of the need of new machines to meet the growth of the Industry.



CATERPILLAR HAUL-OFF

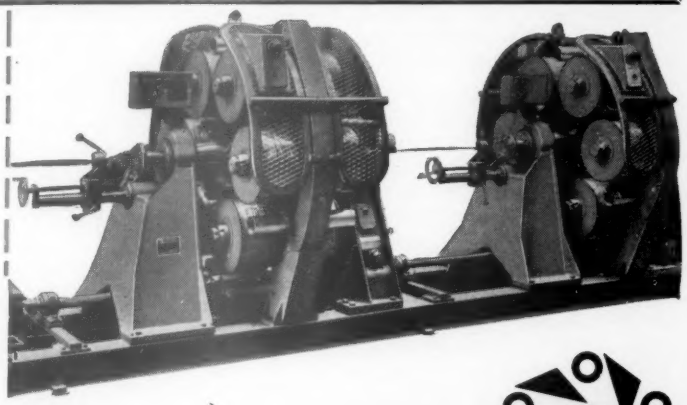
The Caterpillar Haul-Off uses endless belts of rubber shoes which fully protect the cable during haul-off. Grip may be pre-selected and simply controlled. It is positive and constant throughout operation. The unit does not require special foundations or the usual haul-off drum pit. It can be used as a reliable independent measuring device.

INDEPENDENT TAKE-UP DRUM STAND

This Larmuth & Bulmer independent Take-up Drum Stand can be transported from one machine to another. A new traverse action automatically coils without the aid of the usual standby labour. Cable tension and stop mechanism is electrically controlled to dispense with the friction clutch method. Loading is eased by a hydraulic system.

FIXED BOBBIN STRANDING MACHINE

The Larmuth & Bulmer Fixed Bobbin Stranding Machine produces high quality stranding at 50% higher speeds than the Sun and Planet method. Initial costs are low. Floor space is saved. Maintenance is reduced. Many automatic refinements are introduced.



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LB.7

Capacity Measurement—A Method for Wire Mills

by Carlisle Burns
Process Engineer
Wire and Cable Department
General Electric Company
Bridgeport, Connecticut.

A study of procedures for measuring capacity that the author believes could be extended to phases of wire mill production other than the manufacture of magnet wire.

When this article was written, Mr. Burns was with the Small AC Motor and Generator Department of General Electric Co. in Schenectady, N. Y.

I. Introduction—The Problem

The rigorous measurement and definition of the productive capacity of a magnet wire mill is complicated by the lack of a wholly satisfactory unit of product. In a relatively small facility where the range of sizes and types of wire produced is narrow, the problem is not severe. But in a universal mill, supplying all insulations and types across the whole range of sizes, the problem can become quite serious.

★ ★ ★

Enlightened management's need for a substantiated and meaningful measure of magnet wire mill capacity is easily supported.

1. **Production scheduling is simplified.**
2. **Market forecasts may improve in accuracy and timeliness.**
3. **Predictions of equipment needs are more accurate as related to market forecasts.**
4. **The attainment of "balance" in equipment needs is more accurately effected.**
5. **All cost data could be improved in terms of accuracy, timing and verification.**
6. **Those areas tending to optimize profits are more easily determined.**

This study attempts only to introduce and demonstrate a method of adequately satisfying management's requirements; a full analysis would require much more time and effort than has been expended in this brief survey. A plan for such future work is outlined in Section IV.

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The difficulties associated with providing management a meaningful measure of magnet wire mill capacity may perhaps be best illustrated by a brief discussion of the variables influencing "output."

Product Variety

The usual unit of magnet wire production, distribution and sale is the pound of finished wire of a particular size, insulation, and insulation thickness. There are about 50 standard round wire sizes in current use, upwards of 5,000 rectangular cross sections, probably fifteen different film insulations available in four different standard thicknesses ("builds"), and a large variety of "fabric" insulations (e.g., tapes, yarns, fibers and impregnants in a variety of sizes, shapes, chemical compositions and combinations). Two metals, aluminum and copper, are the primary conductor materials.

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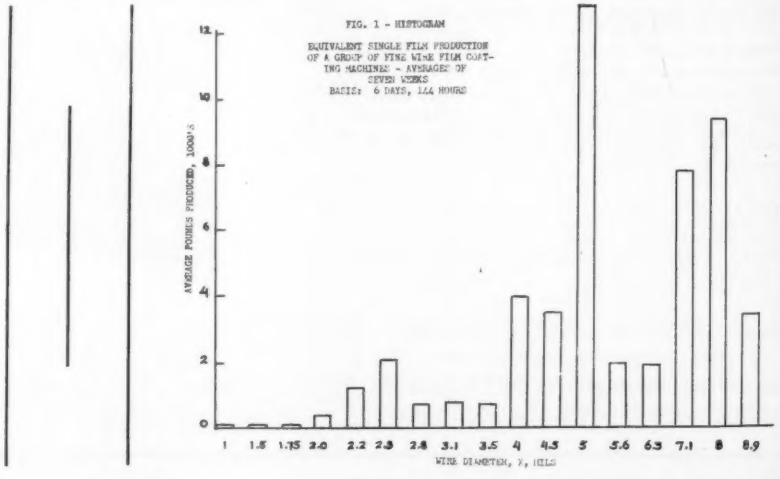
The histogram, Figure 1, illustrates the variety occurring in a narrow section of the broad spectrum; note that this chart ignores all sources of variety except wire diameter.



Processes

The magnet wire manufacturing process may be conveniently divided into three broad areas: (1) wire drawing, where the primary raw material is reduced in cross section to a desired finished size, annealed, and/or cold rolled; (2) film insulation, where liquid film coatings are applied to achieve the physical, chemical and electrical characteristics desired in the end product; and (3) fabric insulation where tapes, yarns, etc., are applied either to bare conductors or over previously film insulated wires. The speed (i.e., linear speed of the wire) of any of the machines in the three groups is inherently constant and continuous and is usually determined by limitations in the equipment or process. Examples of such limitations in drawing machines include horsepower capacity of the driving motor, temperature and wear of the

drawing dies, mechanical inadequacies in the packaging apparatus. Speed limitations in film insulating are usually associated with the time-temperature curing process of the insulation. Insulating speeds are much slower than drawing speeds and multiple strands ("heads") are insulated simultaneously in the same machine.

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In general, the appropriate speed range has been empirically determined for each wire size and insulation manufactured on a particular machine type. Inspection of these data for film coating machines (upon which this report will concentrate) shows that wire speeds vary inversely to wire size; i.e., larger wires are insulated at lower linear speeds than smaller wires. Thus, it is seen that the output of a given machine, weight per unit time, changes when the wire size is changed. For example, the weight-per-unit-time capacity of a fine wire film coating machine is reduced approximately 94% when producing 0.0015" diameter wire from the capacity when producing 0.008" diameter wire.

II. Solution Approach

The problem is not one of single machine capacity, which, as pointed out above, is not severe. Rather, the problem is the determination of the capacity of a group of machines. The very magnitude of numbers of machines and their individual idiosyncrasies, wire sizes, insulations, etc., tends to make the problem seem formidable. However, this fact of magnitude may be usefully employed to effect a solution through a statistical analysis. The statistical approach permits representation of large masses of data in a few significant numbers. Moreover, these numbers have associated with them meaningful limits defining a confidence interval at a specified level of reliability.

Product Mix

The product mix is a familiar concept which may be usefully employed. For present purposes, product mix is defined as the total array of wire sizes with associated weights of each size, type and kind of insulation which may be in process in the mill at any given moment. Now, product mix is not predictable with any degree of certainty because it is influenced by customers' orders, by scheduling, by emergency conditions and by a multitude of other forces.

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It is possible to estimate the product mix statistically, through a sampling procedure, however. This has been done (1)* for a group of fine wire insulating machines for a period of seven weeks. This raw data consisted of weights and insulations applied to seventeen fine wire sizes from 0.001" diameter to 0.0089" diameter. This raw data was converted to a common base for a simplified analysis consistent with available time and effort. This conversion consists of calculating the equivalent single-film-addition output where triple, heavy or quadruple film additions were actually manufactured.

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A conventional fine wire insulating machine produces 16 simultaneous strands of single-film-addition product, but the output is reduced for triple, heavy and quadruple film additions as follows:

	Strands	Passes	Equivalent Single Multiplier
Single	16	4	1
Heavy	10	6	16/10 = 1.6
Triple	8	8	16/8 = 2.0
Quadruple	6	10	16/6 = 2.67

Statistical Measures

The refined data obtained in the preceding section was then subjected to a statistical analysis to determine the following measures. (Calculations were performed with a Friden desk calculator utilizing the accumulative multiplication feature of the machine; results were recorded on the tabular calculation sheet, Table I in the Appendix at the end of the article.)

a) $\overline{X}$ = the weighted mean wire size for each of the seven weeks. This single value represents the total production of all sizes in the fine wire range for a given week.

b) σ = the weighted standard deviation of the distribution of seventeen wire sizes around the mean size, $\overline{X}$. This value is a measure of the "spread" of the data.

c) $\overline{\overline{X}}$ = the weighted mean of the distribution of sample means. This single value approximates the weighted mean ($\overline{X}'$) of the total universe from which the sample values are drawn; it represents the total universe of weighted mean wire sizes past, present and future available from this equipment assuming no major changes in processes or in customer demands.

d) $\sigma_{\bar{x}}$ = the weighted standard error of the mean. This value is a measure of the spread of sample means ($\overline{X}$) about the grand mean ($\overline{\overline{X}}$) of the sample means.

e) Confidence Limits = the confidence limits associated with $\overline{\overline{X}}$ were computed to show with 90% certainty the range of variation to be expected in any weekly mean, $\overline{X}$. The confidence limits thus state the probability that the mean wire size (for any week) will lie between two specified limits 90 weeks of every 100 weeks; or, that the mean wire size will be expected to fall outside these limits 10 weeks of every 100 weeks by chance alone.

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These statistical measures may be highly interesting but they are of little value alone. To complete the analysis, mean wire diameter must be related to the production, wieght per unit time.

Wire Size versus Wire Speed

As was mentioned previously, the linear speed of the wires in film insulating processes varies approximately inversely as wire diameter. These data were arranged on a scatter diagram and a linear regression curve was fitted by the method of least squares; an equation relating wire speed and wire diameter results. Now, wire speed and size (diameter) also determine the weight per unit time output of the machinery. Thus, it is seen that an equation relating time production and wire diameter is obtained.

Capacity

Combination of the equation for output (as a function of diameter) and the statistical measures defining a mean wire size yield an expected range of capacity within specified limits and at a specified level of reliability.

* Numbers in parenthesis refer to bibliography of sources in Appendix.

III. Computations

Mean Wire Diameter, $\overline{X}$

The mean wire diameter was computed for each week from the equation,

$$\overline{X} = \frac{X_{1.0}W_{1.0} + X_{1.5}W_{1.5} + \cdots + X_{8.9}W_{8.9}}{W_{1.0} + W_{1.5} + \cdots + W_{8.9}} = \frac{\sum_{1.0}^{8.9}(XW)}{\sum_{1.0}^{8.9}(W)}$$

where X = wire diameter, mils and
W = weight, pounds of equivalent single build wire of X diameter produced in the particular week,
Subscripts 1.0, 1.5.....8.9 refer to wire diameters; see Table I, Appendix.

Standard Deviation of Samples, σ

The standard deviation of each weekly distribution of wire sizes was computed from the equation,

$$\sigma = \frac{W_{1.0}d_{1.0}^2 + W_{1.5}d_{1.5}^2 + \cdots + W_{8.9}d_{8.9}^2}{W_{1.0} + W_{1.5} + \cdots + W_{8.9}}$$

or

$$\sigma^2 = \sqrt{\frac{\sum_{1.0}^{8.9}(Wd^2)}{\sum_{1.0}^{8.9}(W)}}$$

where d is the deviation of each value of X from the weighted mean $\overline{X}$; $d = X - \overline{X}$. See Table I.

Universe Mean, $\overline{X}'$

The universe mean is that value of wire size (X) which represents the average wire size made on the group of machines in the past or in the future as long as the process is not seriously changed and as long as customers' demands do not shift radically. The universe mean $\overline{X}'$ represents the product mix; it is susceptible to mathematical treatment and is therefore extremely useful in predicting capacity, as will be seen.

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The universe mean cannot be calculated—it may only be estimated. It is statistically proven (2) that the means of the distribution of sample mean is approximately the mean of the universe from which the samples were taken, i.e., $\overline{X}' \doteq \overline{\overline{X}}$. Further, it can be shown (3) that the distribution of sample means will be approximately normal despite a non-normal universe. The reliability of these statements improves as the number of samples is increased; in the present case seven samples of data are used.

TABLE II

GRAND MEAN AND STANDARD ERROR

	$\overline{X}$ (Mils)	P (= Σ W) Lbs.	$\overline{X} - \overline{\overline{X}}$	$(\overline{X} - \overline{\overline{X}})^2$	σ
1	6.0392	56,664	0.2132	0.045445	1.830
2	5.6758	50,739	0.1502	0.02256	1.770
3	5.7963	53,467	0.0297	0.00088	1.687
4	5.9204	51,811	0.0944	0.00891	1.949
5	5.8934	48,448	0.0674	0.00454	1.976
6	5.6476	45,385	0.1784	0.03182	2.035
7	5.7663	48,608	0.0597	0.00356	1.876
					13.123

ΣP = 355,122 $\quad\quad$ $\Sigma(P(\overline{X} - \overline{\overline{X}})^2)$ = 6,065.887

$\Sigma \overline{X}P$ = 2,068,970.34

$$\overline{\overline{X}} = \frac{\sum_1^7(\overline{X}P)}{\sum_1^7 P} = \frac{2,068,970.34}{355,122} = 5.8260 \text{ MILS}$$

$$\sigma_{\overline{X}}^2 = \frac{\sum_1^7[P(\overline{X} - \overline{\overline{X}})^2]}{\sum_1^7 P} = \frac{6,065.89}{355,122} = 0.01708$$

$$\sigma_{\overline{X}} = 0.01307 \text{ MILS}$$

Table II is a tabular computation of the mean ($\overline{\overline{X}}$) of the sample means ($\overline{X}$) calculated in Table I. where

$$\overline{\overline{X}} = \frac{\sum_{1.0}^{8.9}(\overline{X}P)}{\sum_{1.0}^{8.9}P}, \text{ where } P = \sum_{1.0}^{8.9}W$$

is the total weight of equivalent single film wire produced in a given week on the group of machines. Thus $\overline{\overline{X}} = \overline{X}' = 0.0058260$ inch.

Standard Error of the Mean, $\sigma_{\overline{X}}$

The standard error of the mean is the standard deviation of the distribution of sample means; this is a measure of the spread of the data around the central tendency of the means, $\overline{\overline{X}}$, which is assumed equal to the universe mean. The standard error of the mean is used in the next section to compute the limits of the confidence interval associated with the universe mean.

$$\sigma_{\overline{X}} = \sqrt{\frac{\sum_{1.0}^{8.9}[P(\overline{X} - \overline{\overline{X}})^2]}{\sum_{1.0}^{8.9}P}}$$

where the symbols retain their assigned definitions. Thus,

$\sigma_{\overline{X}} = 0.0001317$ inch;

see tabular calculations, Table II.

Confidence Interval

The confidence interval concept gives meaning to the fact that the universe mean is an approximation obtained from sample data. We already have an estimate of the universe mean in the form of $\overline{\overline{X}} \doteq \overline{X}'$. Now, management requires some further measure specifying the probable limits to which $\overline{X}$ will vary. Obviously, any change in $\overline{X}$ will cause a change in the capacity of the equipment. Therefore, confidence limits are computed around $\overline{X}'$ as follows.

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Because only seven samples are involved, the confidence interval is calculated with the aid of the "t" or "Student's" distribution ($7 < 30$). The confidence level is taken at 90%. Other confidence levels may be used if necessary or desirable. The limits are computed as follows:

Confidence Limits $= \overline{\overline{X}} \pm t_{.10}\sigma_{\overline{X}}$

where $t_{.10} = 1.943$ for 6 (N−1) degrees of freedom. From the tabular computation of Table II, the values of $\overline{\overline{X}}$ and $\sigma_{\overline{X}}$ are inserted in the equation.

Confidence Limits
$= 5.8260 \pm 1.943\ (0.1307)$
$= 5.8260 \pm 0.2540$
$= 6.0800$ mils
$\quad 5.5720$ mils
$= .0060800$ inch
$\quad .0055720$ inch

Regression of Wire Speed on Wire Diameter

The empirical data relating wire speed and diameter are plotted on Curve I. Note that two speed plateaus occur between 1.40 mils and 4.00 mils diameter. Two regression calculations were performed, one using all the points on the plot and the second using the midpoints of the two speed plateaus. Wire sizes below 1.40 mils diameter were ignored completely in both computations.

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The regression is accomplished by the method of least squares which yields a mathematically precise "fit" of the data to a straight line.

The estimating equations are

$$(1)\ \Sigma S = NA + B\Sigma X$$

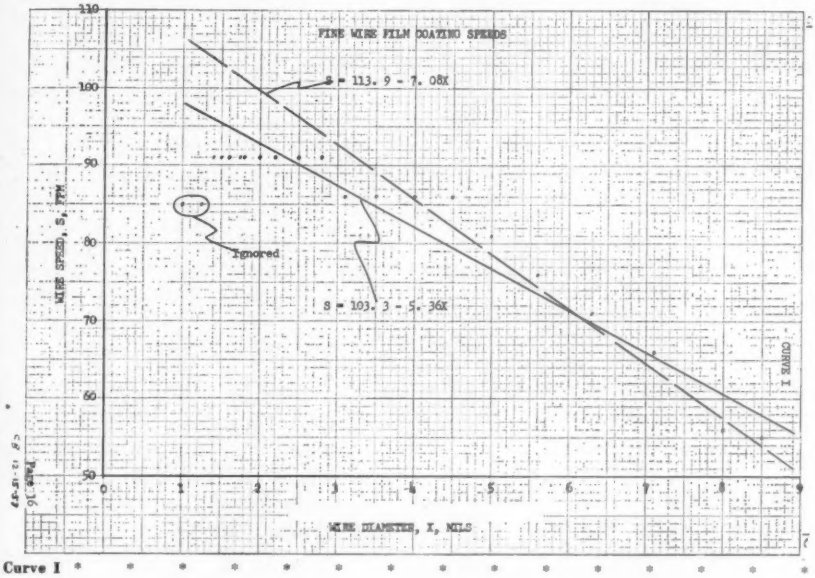
$$\text{and } (2)\ \Sigma SX = A\Sigma X + B\Sigma X^2,$$

where the indicated summations are performed over the range of wire sizes from 1.40 to 8.90 mils. The tabular computation of Table III then yields the required data for simultaneous solution of equations (1) and (2) and evaluation of constants A and B. The regression curves are found to be

$$(3)\ S = 103.3 - 5.36\ X \text{ (full data)}$$

$$\text{and } (4)\ S = 113.9 - 7.08\ X \text{ (using midpoints of speed plateaus),}$$

where X is wire diameter, mils, and S is wire speed, fpm. Equation (4) above is felt to be more representative and is used in future computations. (Note: The choice is somewhat arbitrary; others might select Equation (3).)



Curve I

TABLE III

LINEAR REGRESSION CALCULATIONS

X	S Full Data	X^2	XS	X	S Mid Points	X^2	XS
1.00	85	1.00					
1.20	85	1.44	Ignored				
1.25	85	1.56					
1.40	91	1.96	127.4				
1.50	91	2.25	136.5				
1.60	91	2.56	145.6				
1.75	91	3.06	159.2				
1.80	91	3.24	163.7	1.80	91	3.24	163.7
2.00	91	4.00	182.0				
2.20	91	4.84	200.2				
2.5	91	6.25	227.5				
2.8	91	7.85	254.8				
3.1	86	9.61	266.6				
3.5	86	12.26	301.0	3.75	86	14.10	322.5
4.0	86	16.00	344.0				
4.5	86	20.25	387.0				
5.0	81	25.00	405.0	5.0	81	25.00	405.0
5.6	76	31.40	425.5	5.6	76	31.40	425.5
6.3	71	39.75	447.0	6.3	71	39.75	447.0
7.1	66	50.50	468.0	7.1	66	50.50	468.0
8.0	56	64.00	448.0	8.0	56	64.00	448.0
8.9	55	72.40	489.5	8.9	55	72.40	489.5
Sums	73.55	1,568	377.13	5,577.3	46.45	582	300.39	3,169.2

* Linearity or x^2 indicated are not representative of actual practice.
** These data are arbitrarily chosen to demonstrate the method.

Production

Derivation of the equation for wire production as a function of diameter and speed is straightforward. Production, weight per unit time, is simply the product of wire speed and weight per length. In the present case the following assumptions were made.

(1) Weight of film addition was ignored.

(2) Machines operate 144 hours per week.

(3) 16 simultaneous strands being insulated per machine.

(4) ρ = specific weight of copper = 0.321 lb/cu. in.

The resulting equation is

$$P = 60S\left(\frac{\pi}{4} \times \frac{X^2}{10^6}\right)(12P)(144)(80 \times 16)$$

or

$$(5)\ P' = 33.45\ X^2S,$$

where

P′ = equivalent single-film-addition capacity at 100% machine utilization, pounds per week;

X = wire diameter, mils;

and

S = wire speed, fpm.

Note the primed symbol P′ is used to distinguish 100% efficiency output from actual output, P, ($= \Sigma W$).

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Now, it is seen that capacity expression is achieved by substitution of equation (4) in equation (5) as follows

$$(5)\ P' = 33.45\ X^2S,$$

$$= 33.45\ X^2\ (113.9 - 7.08\ X),$$

$$\text{or } (6)\ P' = 3810\ X^2 - 239\ X^3.$$

Since the weighted mean of the distribution of individual wire sizes represents the most expected value for sizes and weights in the distribution, we may replace X of equation (6) by $\overline{X}$.

$$(7)\ P' = 3810\ \overline{X}^2 - 239\ \overline{X}^3.$$

Machine Utilization

The remaining step is the relation of equation (7) to actual production, because equation (7) is based on 100% (i.e., perfect) utilization of equipment. A reduction in the values obtained by equation (7) is therefore indicated. An estimate of this reduction is obtained by the computations of Table IV, Appendix. Equation (7) is used to compute the perfect production capability, P′, by substitution of the means, $\overline{X}$, previously computed for the seven weeks of sample data. These numbers are then compared to actual production, P, to obtain a measure of the machine utilization. The average of these seven ratios can be used to modify equation (7) as follows:

$$(8)\ P' = \sigma\ (3810\ \overline{X}^2 - 239\ \overline{X}^3),$$

where

σ = 0.619 for the seven weeks of sample data.

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Curve II illustrates the changes in capacity to be expected with shifts in $\overline{X}$ for values of η of 62% and 100%; these data are obtained from the tabular computations of Table V.

Confidence Interval Revisited

Table IV also includes computation of capacity at $\overline{\overline{X}}$ and at the confidence limits. Application of $\eta = 0.62$ indicates that the capacity of the group of fine wire insulating machines will vary between 47,600 pounds per six day week and 54,000 pounds per six day week, 90% of the time. If it is desired to have a capacity estimate with less spread, then confidence in the estimate must necessarily be reduced. For example, at the 80% confidence level, the confidence interval will be defined by

$$\text{Confidence Limits} = 5.8260 \pm 1.440\ (0.1307)$$

$$= 5.8260 \pm 0.1882$$

$$\text{Confidence Limits} = 5.6378 \text{ mils}$$

$$6.0142 \text{ mils}$$

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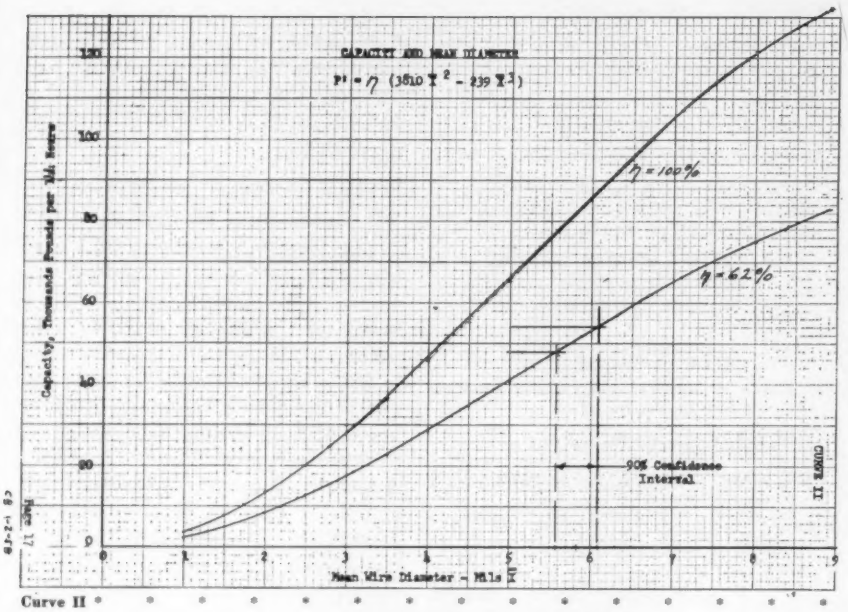
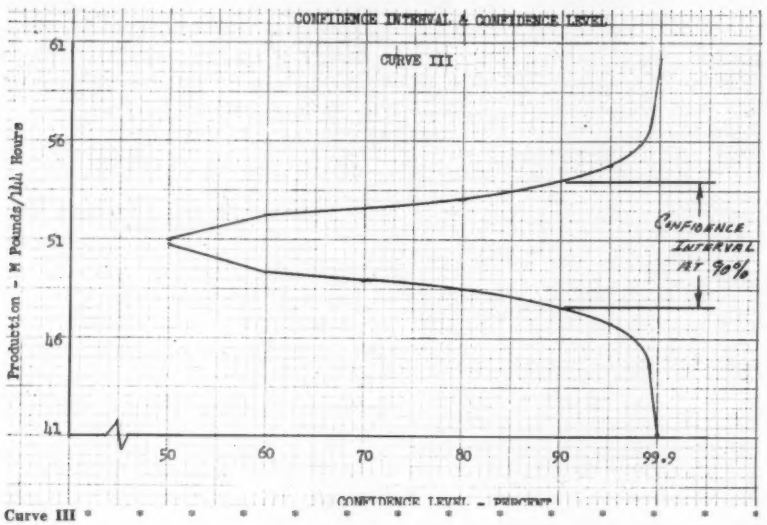
Substitution of these values in


CAPACITY AND MEAN DIAMETER
P' = η (3810 X̄ ² - 239 X̄ ³)
η = 100%
η = 62%
90% Confidence Interval
Capacity, Thousands Pounds per 144 Hours
Mean Wire Diameter - Mils X̄
CURVE II

Curve II


CONFIDENCE INTERVAL & CONFIDENCE LEVEL
CURVE III
CONFIDENCE INTERVAL AT 90%
Production - M Pounds/144 Hours
CONFIDENCE LEVEL - PERCENT

Curve III

equation (8) above, again applying $\eta = 0.62$, yields a capacity estimate of 48,478 pounds per six day week to 53,070 pounds per six day week, 80 times out of a 100. Thus, it is seen that as the capacity estimate is tightened (or made more precise), the confidence placed in the estimate must be reduced. A graphical representation of this variation is given in Curve III for the data of the current problem.

IV. Conclusion

The procedures outlined in this study could conceivably be extended to other film coating equipment and to the wire drawing equipment which supplies bare wire for insulating. (Such a study should include a further dimension of the product mix, film addition, which was ignored in this study.) A detailed investigation of all the productive machinery of the mill could provide many of the answers mentioned in the Introduction.

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The primary weakness of the method outlined here is dependence on past measurements of weighted mean wire size as an indication of future product mix. Therefore, frequent reappraisals of the mix, by sampling technique, should be performed. Such reappraisals could be performed quarterly using data for the preceding three months. In this manner, the trend of the mix could be rigorously established, if the mix is indeed changing. A control chart of the mean wire diameter with limits for the 90% confidence interval would serve as a record of the variation of the mean diameter (or product mix).

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Computations establishing the means and confidence intervals should be based on more samples than the data presented here. Perhaps a full year should be studied to determine possible seasonal variations and to increase the reliability of the estimates.

TABLE V

$P' = (3810\ \bar{X}^2 - 239\ \bar{X}^3)\ \eta$

CAPACITY AND MEAN DIAMETER

X̄	X̄²	X̄³	3810 X̄²	239 X̄³	P' η = 100%	P' η = 62%
1.0	1.00	1.00	3,810	239	3,571	2,230
1.5	2.25	3.38	8,573	808	7,765	4,815
1.75	3.06	5.37	11,659	1,283	10,376	6,430
2.0	4.00	8.00	15,240	1,912	13,328	8,260
2.2	4.84	10.66	18,440	2,548	15,892	9,850
2.5	6.25	15.64	23,813	3,738	20,075	12,460
2.8	7.85	22.00	29,909	5,258	24,651	15,280
3.1	9.61	29.80	36,614	7,122	29,492	18,280
3.5	12.26	42.90	46,711	10,253	36,458	22,600
4.0	16.00	64.00	60,960	15,296	45,664	28,300
4.5	20.25	91.2	77,153	21,797	55,356	34,300
5.0	25.00	125.00	95,250	29,875	65,375	40,500
5.6	31.40	176.00	119,634	42,064	77,570	47,100
6.3	39.75	250.0	151,448	59,750	91,698	56,800
7.1	50.50	358 0	192,405	85,562	106,843	66,200
8.0	64.00	512.0	243,840	122,368	121,472	75,200
8.9	79.40	706.0	302,514	168,734	133,780	82,900

TABLE VI

CONFIDENCE INTERVAL & CONFIDENCE LEVEL

$\bar{X} \pm t\sigma_{\bar{X}}$ $\quad \sigma_{\bar{X}} = 0.1307$ $\quad \bar{\bar{X}} = 5.8260$

Confidence Level	t(4)*	$t\sigma_{\bar{X}}$	Confidence Interval $\bar{\bar{X}} + t\sigma_{\bar{X}}$	$\bar{\bar{X}} - t\sigma_{\bar{X}}$
50%	0.718	.00938	5.8354	5.8166
60%	0.906	.1182	5.9442	5.7078
70%	1.134	.1481	5.9741	5.6779
80%	1.440	.1880	6.0140	5.6380
90%	1.943	.2540	6.0800	5.5720
95%	2.447	.3195	6.1455	5.5065
98%	3.143	.411	6.2370	5.4150
99%	3.707	.485	6.3110	5.3410
99.9%	5.959	.778	6.6040	5.0480

* At six degrees of freedom

V. Appendix

Bibliography

(1) Data are representative only.

(See pages 587, 588 and 589 for Tables I and IV, and then turn to page 633.)

TABLE I

SAMPLE MEANS AND STANDARD DEVIATIONS

X Wire Dia. Mils	(1) W/E 5/12/56 W_1LB	d_1	d_1^2	(2) W/E 5/19/56 W_2LB	d_2	d_2^2	(3) W/E 5/26/57 W_3LB	d_3	d_3^2	(4) W/E 6/2/56 W_4LB	d_4	d_4^2
1.0	10	-5.04	25.40									
1.5												
1.75				90	-3.93	15.44						
2.0				135	-3.68	13.54				520	-3.92	15.37
2.2	942	-3.84	14.75	1,256	-3.48	12.11	1,421	-3.60	12.96	1,256	-3.72	13.84
2.5	1,579	-3.54	12.53	1,783	-3.18	10.11	2,191	-3.30	10.89	2,040	-3.42	11.70
2.8	1,296	-3.24	10.50	776	-2.88	8.29	256	-3.00	9.00	512	-3.12	9.73
3.1	1,088	-2.94	8.64	912	-2.58	6.66	604	-2.70	7.29	900	-2.82	7.95
3.5	1,420	-2.54	6.45	1,156	-2.18	4.75	390	-2.30	5.29	780	-2.42	5.86
4.0	3,458	-2.04	4.16	3,460	-1.68	2.82	3,952	-1.80	3.25	4,460	-1.92	3.69
4.5	2,492	-1.54	2.37	4,635	-1.18	1.39	5,395	-1.18	1.39	2,492	-1.42	2.02
5.0	13,863	-1.04	1.08	12,824	-0.68	0.46	11,591	-0.80	0.64	13,072	-0.92	0.85
5.6	2,000	-0.44	0.19	3,780	-0.08	0.01	2,960	-0.20	0.40	1,700	-0.32	0.10
6.3	2,042	0.26	0.07	2,368	0.62	0.38	2,392	0.50	0.25	2,018	0.38	0.14
7.1	9,656	1.06	1.12	6,074	1.42	2.02	12,059	1.30	1.69	8,457	1.18	1.39
8.0	13,838	1.96	3.84	10,000	2.32	5.38	10,256	2.20	4.84	7,644	2.08	4.33
8.9	2,980	2.86	8.18	1,490	3.22	10.37				5,960	2.98	8.88
ΣW	56,664			50,739			53,467			51,811		
ΣXW	342,210.70			287,984.50			309,910.90			306,744.90		
$\bar{X}$	6.0392			5.6758			5.7963			5.9204		
$\Sigma (Wd^2)$	189,962.03			159,009.06			152,187.43			196,784.51		
σ^2	3.3524			3.1338			2.8463			3.7981		
σ	1.83			1.770			1.687			1.949		

Notes: (1) W = Pounds equivalent single Formex produced. (2) ΣXW and ΣWd^2 performed directly on Friden Desk Calculator.

TABLE I - CONTINUED

SAMPLE MEANS AND STANDARD DEVIATIONS

X Wire Dia. Mils	(5) W/E 6/9/56 W_5LB	d_5	d_5^2	(6) W/E 6/16/56 W_6LB	d_6	d_6^2	(7) W/E 6/23/56 W_7LB	d_7	d_7^2	Sums	Average
1.0										10	1.4
1.5	73	-4.39	19.27	73	-4.15	17.22	73	-4.27	18.23	219	31
1.75										90	13
2.0	520	-3.89	15.13	660	-3.65	13.32	525	-3.77	14.21	2,360	337
2.2	1,421	-3.69	13.62	1,256	-3.45	11.90	1,256	-3.57	12.74	8,808	1,250
2.5	2,252	-3.39	11.49	2,252	-3.15	9.92	2,191	-3.27	10.69	14,288	2,040
2.8	512	-3.09	9.55	776	-2.85	8.12	776	-2.97	8.82	4,904	700
3.1	604	-2.79	7.78	1,208	-2.55	6.50	308	-2.67	7.13	5,624	800
3.5	390	-2.39	5.71	390	-2.15	4.62	766	-2.27	5.15	5,292	755
4.0	3,460	-1.89	3.57	4,476	-1.65	2.72	3,968	-1.77	3.13	27,234	3,885
4.5	2,631	-1.39	1.93	3,392	-1.15	1.32	3,392	-1.27	1.61	24,429	3,480
5.0	13,143	-0.89	0.79	13,180	-0.65	0.42	12,451	-0.77	0.59	90,124	12,850
5.6	1,700	-0.29	0.08				1,730	-0.17	.03	13,870	1,980
6.3	1,009	0.41	0.17	2,068	0.65	0.42	2,066	0.53	0.28	13,963	1,990
7.1	8,387	1.21	1.46	2,378	1.45	2.10	7,278	1.33	1.77	54,289	7,750
8.0	6,386	2.11	4.45	8,806	2.35	5.52	8,838	2.23	4.97	65,768	9,380
8.9	5,960	3.01	9.06	4,470	3.25	10.56	2,990	3.13	9.80	23,850	3,400
ΣW	48,448			45,385			48,608			355,122	50,662
ΣXW		285,527.60			256,316.50			280,292.40			
$\bar{X}$		5.8934			5.6476			5.7663			
(Wd^2)		189,100.28			188,131.55			171,165.88			
σ^2		3.9031			4.1452			3.5213			
σ		1.976			2.035			1.876			

Notes: (1) W = Pounds equivalent single Formex produced. (2) ΣXW and ΣWd^2 performed directly on Friden Desk Calculator.

TABLE IV

TABLE IV

MACHINE UTILIZATION AND CONFIDENCE LIMITS

Confidence Limits		$\bar{X}$	$\bar{X}^2$	$\bar{X}^3$	$3810\,\bar{X}^2$	$239\,\bar{X}^3$	P' LBS.	P LBS.	P/P'
	1	6.0392	36.4719	220.2611	138,958	52,642	86,316	56,664	0.656
	2	5.6758	32.2147	182.8442	122,738	43,700	79,038	50,739	0.642
	3	5.7963	33.5971	194.6345	128,005	46,518	81,487	53,467	0.656
	4	5.9204	35.0511	207.5165	133,545	49,596	83,949	51,811	0.617
	5	5.8934	34.7322	204.6907	132,330	48,921	83,409	48,448	0.581
	6	5.6476	31.8954	180.1325	121,521	43,052	78,469	45,385	0.578
	7	5.7663	33.2502	191.7306	126,683	45,824	80,859	48,608	0.601
									4.331
	90%	6.0800	36.9664	224.7557	140,800	53,700	87,100	54,000	
		5.8260	33.9422	197.7473	129,320	47,262	82,058	50,900	
		5.5720	31.0	172.5	118,000	41,200	76,800	47,600	
	50%	5.8354	34.11	199.20	129,959	47,609	82,350	50,975	
		5.8166	33.87	197.12	129,045	47,112	81,933	50,717	
	60%	5.9442	35.28	209.56	134,417	50,085	84,332	52,202	
		5.7078	32.60	186.15	124,206	44,490	79,716	49,344	
	70%	5.9741	35.64	212.77	135,788	50,852	84,936	52,575	
		5.6779	32.26	183.24	132,911	43,794	79,117	48,973	
	80%	6.0140	36.12	217.08	137,617	51,882	85,735	53,070	
		5.6380	31.81	179.41	121,196	42,879	78,317	48,478	
	95%	6.1455	37.82	232.59	144,094	55,589	88,505	54,785	
		5.5065	30.36	167.28	115,672	39,980	75,692	46,853	
	98%	6.2370	38.94	242.99	148,361	58,075	90,286	55,887	
		5.4150	29.38	159.24	111,938	38,058	73,880	45,732	
	99%	6.3110	39.82	251.26	151,714	60,051	91,663	56,739	
		5.3410	28.52	152.30	108,661	36,400	72,261	44,730	
	99.9%	6.6040	43.56	287.50	165,964	68,713	97,251	60,198	
		5.0480	25.50	128.78	97,155	30,778	66,377	41,087	

$$\eta = \frac{4.331}{7} = 0.619$$

Continental Steel's New Nail Mill

Advanced nail cleaning techniques and packaging processing are among the features of the new mill described in this article.

The latest of several recent expansions made by **Continental Steel Corporation** is the new nail mill at Kokomo, Indiana, completed last year and now in full operation. The new building provides nearly fifty thousand square feet of manufacturing space, and a nail warehouse of over 36,000 square feet. The warehouse is insulated and heated to keep nails moisture-free and in perfect condition until shipment. The nail warehouse has its own enclosed truck and rail loading docks.

★ ★ ★

More than 135 nail machines in the new nail mill turn out nails, rivets and staples of virtually all sizes and types from the smallest nails to 10 inch spikes.

★ ★ ★

A big feature of the new mill are two gigantic Ransohoff cleaning lines, each of which operates completely automatically. Each line encompasses three separate cleaning cycles to produce nails that are "cleaner than clean." Special machines weigh and package the nails automatically.

★ ★ ★

In the nail industry the cleaning method generally followed until quite recently was the old fashioned tumbling process which gave nails a polish but which left them with a greasy film and blunted points. The film made for soiled hands and hence dirty smudges on the work being done, while the blunted points hindered starting and driving.

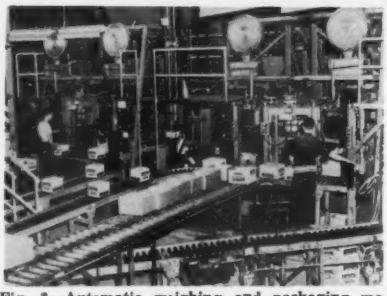


Fig. 3—Automatic weighing and packaging machinery is used. After being packaged, the size, kind and weight of the contents is printed on the carton.

Fig. 4—View of a portion of the new warehouse where nails are stored in a moisture-free atmosphere until shipped out.

The new cleaning method at Continental not only eliminates nail film, but keeps nail points sharp for starting with just a tap of the hammer. In addition, as is well known to nail people, clean nails with unpolished surfaces grip wood fibers more tightly and hold more securely to produce better work, for do-it-yourselfers, as well as expert carpenters.

★ ★ ★

The three successive steps in the cleaning process take place rapidly in each of the two Ransohoff lines. In the first step nails are "dewhiskered"—all steel particles are removed from nail surfaces, but without dulling the points. The nails then pass into a chemical detergent bath at 180°F., the second step, to remove all oil, grease and foreign matter. In the third step, all chemicals from the detergent bath are removed, and the nails are further cleaned and thoroughly dried. By this time they have progressed to the packaging end of the machine where they are automatically weighed and packaged in attractive, easy-to-handle fiber board cartons.

★ ★ ★

In order to construct the new mill it was necessary to close and relocate a city street. The new mill

(*Please turn to page* 636)

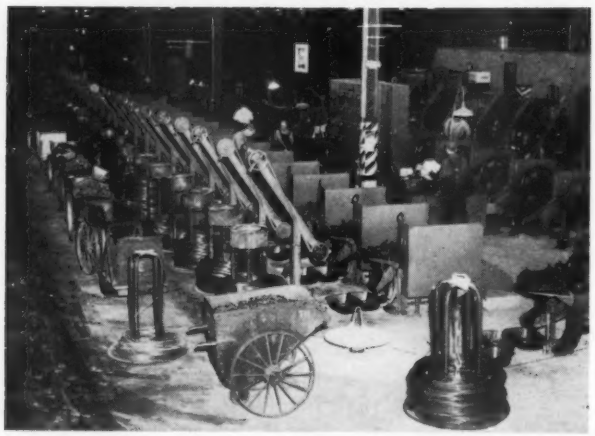


Fig. 1—A few of the 135 nail making machines in Continental Steel's new nail mill at Kokomo, Ind.

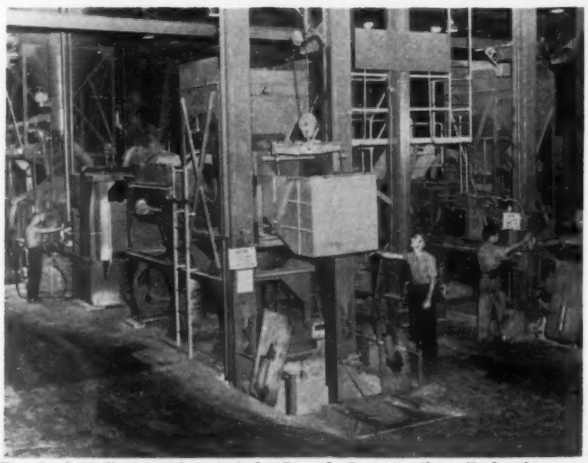
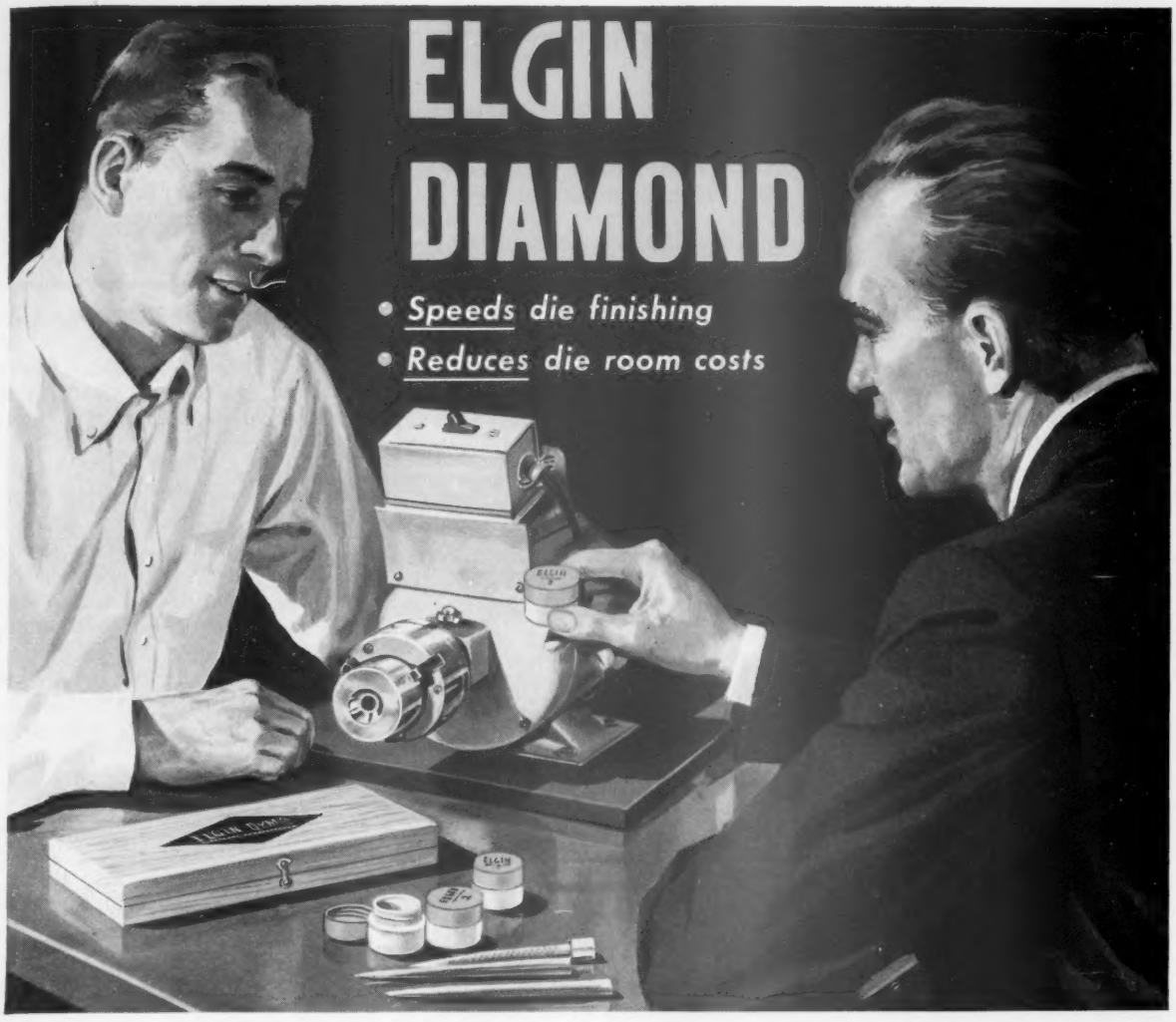


Fig. 2—Overall view of one of the Ransohoff automatic nail cleaning machines.



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Abrasives Division **ELGIN NATIONAL WATCH COMPANY**
ELGIN, ILLINOIS

Thermal Stress-Cracking of Polyethylene II

by

J. H. Heiss, V. L. Lanza and W. M. Martin

Bell Telephone Laboratories, Inc.

Murray Hill, New Jersey

This paper was presented at the Seventh Annual Symposium on Technical Progress in Communication Wires and Cables on December 3, 1958, at Asbury Park, N. J., sponsored by the U.S. Army Signal Research and Development Laboratory.
It is a sequel to one on the same subject given by the authors at the Annual Convention of The Wire Association in October, 1958, containing new material developed following its preparation.

In an earlier report on "The Thermal Embrittlement of Stressed Polyethylene,"[1] it was shown that high density polyethylenes cracked open when heated in a strained condition at temperatures ranging from 23°C to 120°C. The occurrence of cracks was noted with time over this temperature range. When the logarithm of the time to failure was plotted against the reciprocal of the absolute temperature, a linear dependence was obtained. This relation was found to hold for a relatively low strain of about 15 per cent. A hypothesis was proposed involving the elastic deformation of spherulites under low extensions and their subsequent desire to return to the lower energy unstrained structure. It was presumed that this retraction produced sites of inherent weakness or flaws in the gross structure of the polymer due to the disruption of rather weak intercrystallite boundary forces.

★ ★ ★

Our earlier findings indicated that there are three separate and distinct mechanisms which can initiate brittle failure in polyethylenes. These are oxidative, environmental and thermal in nature, and can act singly or in concert. Since polyethylenes can become brittle after heating for periods of time due to gross changes in crystalline texture, we believe that thermal stress-cracking rather than thermal embrittlement more adequately describes the phenomenon with which we are dealing.

★ ★ ★

In the thermal stress-cracking experiments, a rigorous analysis of the nature of the strain involved is obscured since the strain level is too high for mechanical formulae to be strictly applicable. However, it is believed that the strains involved are essentially uniaxial. Further investigation into other levels and types of strain is the basis for this report.

Experimental

The wrap-around test described earlier[1] was used in this investigation, and all specimens tested were thoroughly evacuated and flushed with pre-purified nitrogen. They were tested at elevated temperatures while sealed in the nitrogen atmosphere under somewhat reduced pressure. Strips of a high density (0.96 g/ml) polyethylene of 0.54 melt index were helically wrapped around brass rods having diameters which varied from 0.125 inch to 1.00 inch. Rods were so chosen that calculated strains of 4.8, 9.2, 16.7, 21.0 and 28.8 per cent would be induced in 0.050 inch thick strips if they were bent perpendicular to the rod axis. When these strains were corrected for the helical angle with respect to the rod axis, the strains were found to be 4.7, 8.9, 15.4, 19.5 and 25.2 per cent when derived from simple geometrical considerations in which the neutral axis was presumed to be centrally located. This further assumed that the modulus of elasticity is the same for tension and compression, which is not strictly true for polyethylene. However, the relative strain values are accurate enough for comparative purposes.

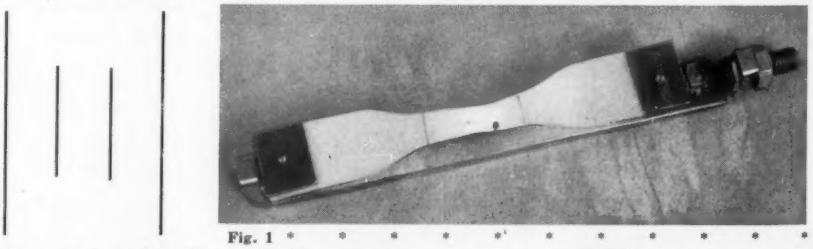

Fig. 1

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It was thought that the helical wrapping might cause a small biaxial component so another type of test was devised in which strips were elongated in uniaxial fashion. This was accomplished by clamping a 0.050 inch thick standard dumbbell specimen between jaws which were mounted in a rack or holder. The apparatus for this tension test is shown in Fig. 1. The jaws could be separated by means of a screw thread through one end of the holder. Marks were made on the narrow straight portion of the specimen and, by tightening the nut, various elongations could be obtained. Strains of 6, 12, 25, 37 and 50 per cent were so induced in specimens of the same high density polyethylene used in the wrap-around test. After thoroughly evacuating and flushing all specimens with pre-purified nitrogen, tests were run in this medium at elevated temperatures and the time to failure was noted. Fig. 1 shows a typical failure in a high density polyethylene specimen.

Results

A number of the high density polyethylene specimens were helically wrapped around the various diameter brass rods and exposed in nitrogen to a temperature of 70°C.

The time to failure was noted under the different strain levels. These data, which appear in Table I and are plotted in Fig. 2, have the per cent strain corrected for the helical angle.

Table I

Time to Failure at Various Strain Levels in the Wrap-Around Test

Per Cent Strain	Average Time to Failure at 70°C (Hours)
4.7	135
8.9	24
15.4	16
19.5	18
25.2	16

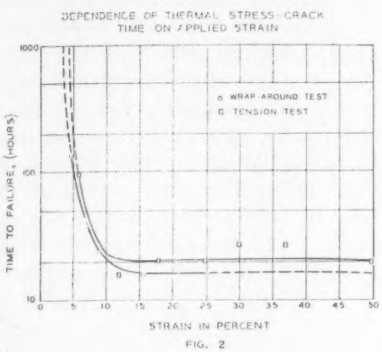


FIG. 2

A number of tensile dumbbell specimens were cut from the same molded sheet used for the wrap-around test and elongated to various strains from 6 to 50 per cent. Tests were run in nitrogen at 70°C and the time to failure was noted under the different strain levels. These data appear in Table II and are also plotted in Fig. 2.

Table II.

Time to Failure at Various Strain Levels in Tension Test

Per Cent Strain	Average Time to Failure at 70°C (Hours)
6	95
12	16
18	20
25	20
30	27
37	27
50	20

Discussion

Before discussing the results of the wrap-around and tension tests, it should be noted that both are constant strain tests. The strain is induced in the polyethylene by a definite applied stress which is fixed at that level. Under conditions of relaxation, the stress will then decay.

★ ★ ★

It may be observed (Fig. 2) that, for both the wrap-around and the tension tests, the time to failure tends towards a constant minimum value beyond some limiting value of strain. Further, within experimental error, the time to failure is about the same in both tests over the range of strains covered. This is interesting in view of the nature of the strain distribution involved. In the tension case, especially at low extensions, the strain is essentially uniaxial and uniform in this direction, while in the wrap-around test there is a differential strain as in beam bending. It does not appear that the initiation of flaws in thermal stress-cracking is associated with biaxiality of stress as in environmental stress-cracking. Indeed, specimens of a 0.92 g/ml density polyethylene, which has poor environmental crack resistance when tested in accordance with the ASTM test ($F_{50} = 0.5$ hrs.), have not cracked in the wrap-around test at 70°C in Igepal CO-630 after eight months. Dumbbell specimens of this polyethylene elongated uniaxially to 30 and 50 per cent did not crack in Igepal CO-630 at 50°C. In a few exploratory experiments, dumbbell specimens of this polyethylene were notched centrally along the long axis to a depth of about 0.025 inch and 1 inch long. When these specimens were elongated 30 per cent, placed in Igepal CO-630 and tested at 50°C, they cracked in relatively short periods of time.

★ ★ ★

It has been observed in the tension test on the 0.96 density polymer that at high extensions some cold drawing occurred. Further, no cracks have been found to occur within the whitened cold drawn area. It is believed that if this polymer is extended to the cold drawn state thermal stress-cracking will not occur because of the disruption of spherulitic structure.

★ ★ ★

Some additional experiments were performed to elicit more information on the thermal stress-cracking phenomenon. To determine if surface flaws caused by the molding process had any effect on thermal stress-cracking, a number of specimens of the same 0.96 density polyethylene were surface polished with a hot nitrogen torch. Subsequent wrap-around tests in nitrogen at 70°C showed no differ-

(*Please turn to page* 626)

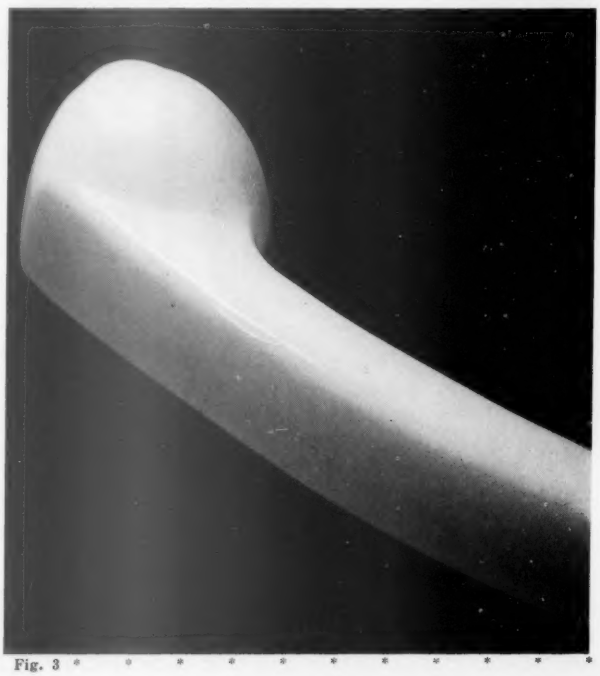


Fig. 3

From Log To Finished Reel

by Henry Carris

President and General Manager
Carris Reels, Inc.
Rutland, Vermont

The production of plywood for making spools and reels has become an important preliminary step in their manufacture. Under the skillful guidance of the author and his associate, both of whom have had long years of experience in plywood and reel manufacture, this interesting development has proven to have many practical advantages.

The product was improved and the cost of manufacture was cut.

★ ★ ★

That's what resulted when our company began to produce its own plywood for the manufacture of spools and reels.

★ ★ ★

The business was established in 1951 in Rutland because of its handy proximity to an abundant source of supply of wood suitable for spool and reel manufacture.

★ ★ ★

In spite of the high degree of competition in the reel field, the business prospered and it was found necessary to move to larger quarters three times, the latest expansion being the moving into its present 30,000 square foot manufacturing plant a little over a year ago, at which time facilities were added to produce the plywood required.

★ ★ ★

While this step had been a matter under consideration for some time, it was not until November, 1957, that an affiliated company was incorporated to produce plywood, thus bringing under direct control the quality of the raw material of its end products—spools and reels. The new arrangement also cut costs, both in reel manufacture and for the buyer of these specialized products. The author's partner in this venture, **Robert S. Bigelow,** is president and general manager of the subsidiary company.

(*Please turn to page* 623)

Fig. 1—Timber, when received from local loggers and farmers, is stored in the yard and log shed.

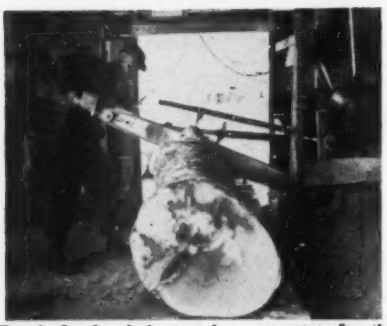


Fig. 2—In the shed, stout logs are cut to length and then bathed in live steam for 24 hours, to condition them for the lathes.

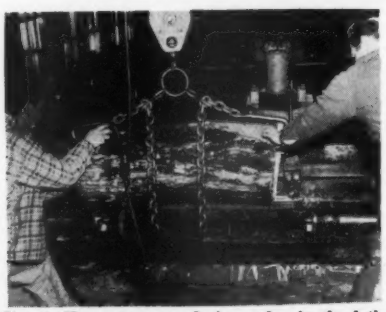


Fig. 3—Here, men are placing a log in the lathe chucks for turning.

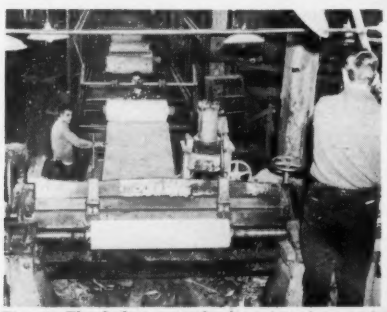


Fig. 4—The lathes peel the logs into long strips of veneer, as shown here.

Fig. 5—These long strips are chopped into various lengths as may be required for different sizes of reels.

Fig. 6—The cut lengths of veneer, being placed in a mechanical drier.

Fig. 7—After grading strips of veneer according to quality and size and eliminating imperfections, they are ready for gluing. This machine is applying glue to a sheet of the veneer.

Ultrasonic Cleaning of Fine Wire Drawing Dies

by John W. Cowan

General Manager

Wayne Wire Die Company

Hillside, New Jersey

The method of cleaning diamond dies during the process of manufacture described here, which does in minutes what formerly took hours, not only has saved time, but contributes to die accuracy. The thought suggests itself that this method may have wider and other applications in the wire industry.

How do you clean a hole drilled in a diamond? Not just an ordinary hole, either, but one so fine it can hardly be seen by the naked eye. Ultrasonic cleaning seems to be the answer.

★ ★ ★

In fine wire drawing diamond dies, having a hole diameter range of from 0.0003 to 0.001 in., a 30 degree cone has to be produced mechanically.

★ ★ ★

A secondary cone, approximately 0.005 in. deep, is drilled electrostatically, and an additional depth of 0.003 to 0.005 is reached by continuous electrostatic sharpening of the needle. Mechanical coning from the opposite side completes the hole. At this stage, cleanliness becomes all-important.

★ ★ ★

Any soils and grinding dust not removed from the front section, obscure the "break-through" from the rear. A few minutes of extra drilling at this stage, and the hole diameter becomes too big.

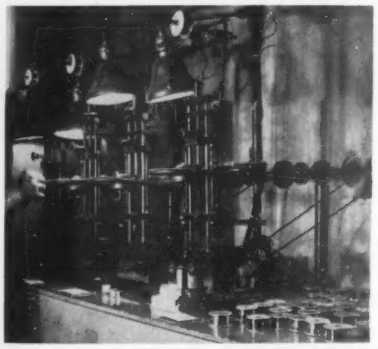
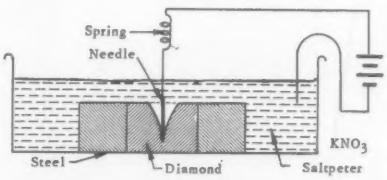


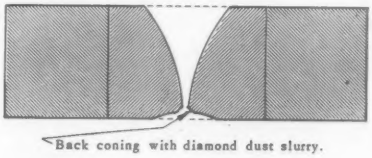
Fig. 1—Three types of motion:—reciprocating, rotational and oscillating—lap die opening to final size on special machines. * * *

With standard cleaning techniques used in the past, our production of extremely fine-sized dies was an extremely low percentage, being almost a matter of pure luck. That's why we installed an ultrasonic cleaning system. As Ted Wedekind, our small-die shop foreman, puts it, "ultrasonics is our blessing; without it, we'd be behind the eight-ball!"

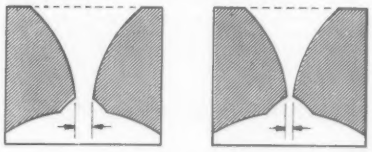
IMPORTANT STEPS IN FINE-WIRE DIE PRODUCTION



Drilling deep cone diamond center with arcing needle. Entire operation performed under saltpeter solution. Scale forms inside cone.



Back coning with diamond dust slurry.



LEFT: Without Ultrasonic Cleaning. Here's what happens if scale is not completely removed. Back coning continues past breakthrough, until hole can be notice, considerably enlarging ID.

RIGHT: Back coning continues until hole is seen by operator.

Wire Dies Cleaned Often During Routing

Our procedures, given below, clearly show the importance of ultrasonic cleaning during production.

★ ★ ★

1. **The** diamond, mounted in a steel matrix, is flattened and spotted with djamond chips held in a pair of longnosed pliers.

★ ★ ★

2. **Ten** to twenty dies at one time are mechanically coned on a multiple-head machine, which imparts both a rotating and a vertically reciprocating motion to the dies. A needle of the desired size makes continuous contact with the diamond, and diamond powder is repeatedly applied until the 30-degree angle, depth, and desired sharpness of the cone have been achieved.

Fig. 2—Die is rotated and oscillated around a reciprocating tungsten wire, so fine it can hardly be seen. Diamond slurry is used to polish ID of die to exact final size. * * * *

Fig. 3—After each step in production, dies are cleaned ultrasonically. Previously, solvent washes and tedious hand-scraping with sharp picks was necessary. At one stage, ultrasonic equipment has now cut cleaning time from 4 hours to ten minutes. This equipment handles Wayne's entire production of fine wire dies. * * *

3. Die is then immersed in a saltpeter solution. A needle, connected to a low voltage source, is carefully suspended from a spring into the front of the cone. When current is passed through, the arcing needle acts as a drill. The hole is made some 0.005 in. deep, then drilled further with a finer needle until the overall depth of the tapered section is approximately 0.008 in. Die is then trued up to make the hole in the diamond concentric with the OD of the metal matrix.

★ ★ ★

4. Die is immersed in a model AP-25-B Sonogen* ultrasonic tank containing Oakite No. 33 to remove all saltpeter scale and grinding soils. This is the most important cleaning operation of all, as step (5) will show.

★ ★ ★

* Registered Trade Mark, Branson Ultrasonic Corporation.

5. Die is turned over, and mounted in back-coning machine. By means of an abrasive slurry a concave impression is ground into the die. Then a continuously sharpened needle and a diamond abrasive are used to drill through to the tapered section. Grinding is stopped as quickly as possible after break-through. Opening of die is indicated by color change of the abrasive slurry. If scale or other contaminants have not been removed ultrasonically from die's tapered section, oil seepage is prevented, there is no color change, and break-through will go unnoticed. Hole is then enlarged more than necessary.

6. Dies are again cleaned ultrasonically and stored until needed. When larger hole is called for, bore is opened up by rotating and oscillating die around a reciprocating tungsten wire. Diamond slurry provides the necessary abrasive action.

★ ★ ★

7. Ultrasonic immersion simplifies cleaning prior to final inspection. It helps to show up any imperfections which need to be polished further.

★ ★ ★

Although no one has ever asked for any diameter smaller than 0.00029 in., we make dies as fine as 0.0001 in. To provide faster delivery, we hold hole diameters of most dies to approximately 0.0002 to 0.00025 in., and simply enlarge the hole to meet specific orders. This is faster than starting with a blank.

Fig. 4—When hole is enlarged, dies are again cleaned ultrasonically, and then inspected under a microscope. * * * * * *

Previous Cleaning Techniques

We installed ultrasonic equipment 2 years ago. Before then, dies were cleaned a number of different ways, but all had serious disadvantages.

★ ★ ★

We tried to remove saltpeter scale with a sharpened stick. Obviously a rough, uncertain, and annoying method.

★ ★ ★

We rinsed dies with gasoline and other solvents in an attempt to wash out the dirt. On a really fine die, this meant spending a few hours on cleaning; and there was still no assurance that all scale had been removed.

Fig. 5—Before and after ultrasonic cleaning. Dies on left still coated with scale and soil. On the right, after a few minutes in ultrasonic tank, dies are free of all soils. * * * *

★ ★ ★

Drilling out the saltpeter scale was also tried. We reimmersed the die into the saltpeter bath, arcing the needle at a lower voltage until the scale was removed. This worked, but obten increased the hole size. More critical, it tied up the drills and slowed production.

Utrasonic Cleaning Allows Full Speed Production

With the ultrasonic process, the removal of saltpeter scale takes about ten minutes. On the average, cleaning time is fifteen minutes. Dies are first immersed in a small tank containing Oakite No. 33, then rinsed in a larger tank containing Liqui-Det detergent.

★ ★ ★

Cleaning is almost automatic. Unlike other methods, it takes no machines out of production, and requires no attention. "We simply put 'em in and forget 'em," to quote our foreman.

How Ultrasonics Cleans

Ultrasonics means "sound beyond hearing". Such sound, under the right conditions, has the energy to clean parts quickly, thoroughly, and without damage.

★ ★ ★

A ceramic transducer mounted inside a tank of liquid converts high-frequency electrical energy into mechanical vibrations, to cause the rapid formation and collapse of thousands of tiny bubbles.

★ ★ ★

Cavitation, as this phenomenon is called, occurs throughout the

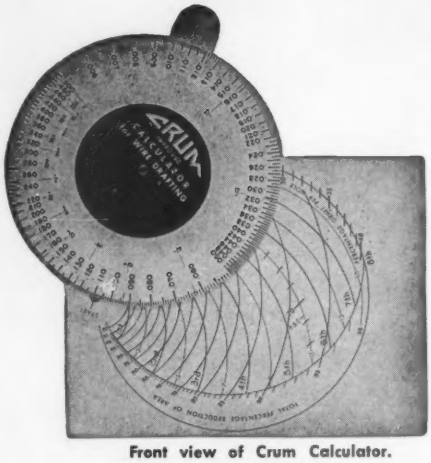
(*Please turn to page* 633)

SAVE SET-UP TIME WITH THE . . .

CRUM CALCULATOR

FOR WIRE DRAFTING

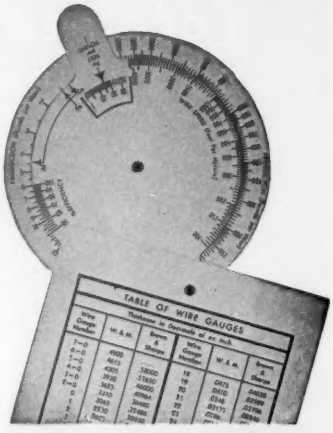
Useful and Accurate!



Front view of Crum Calculator.

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. Provide quicker and more accurate information on die sizes and reduction areas;
2. Calculate wire production rates for various speeds and efficiencies.



Reverse view of Crum Calculator.

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The improved Crum Calculator is worth its weight in gold in time saving —no laborious mathematical calculations necessary when you use it. Instruction sheet with examples accompany each Calculator. You should have one or more in your wire drawing department.

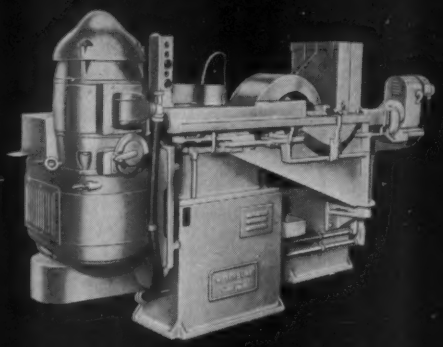
THE PRICE: $5.00 EACH

Send your orders to:

WIRE AND WIRE PRODUCTS

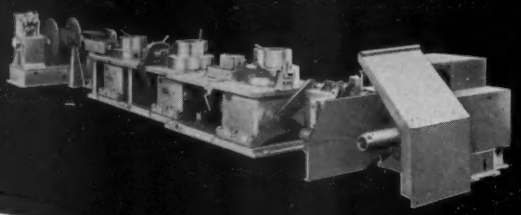
453 MAIN STREET **STAMFORD, CONN.**

(Exclusive distributors)



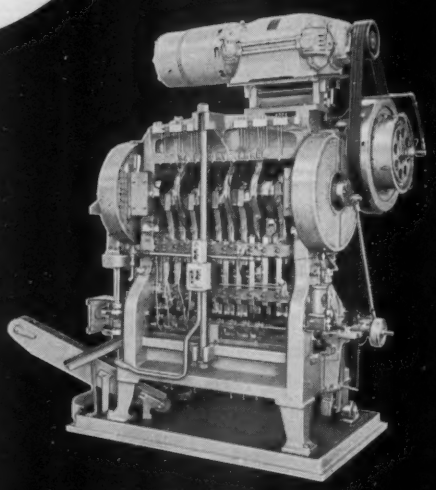
COLD HEADING
MACHINERY

EYELET, SLITTER
& WIRE
MACHINERY

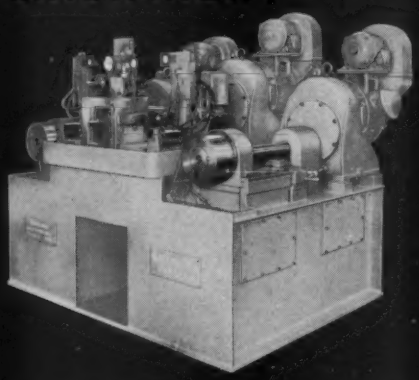


WATERBURY FARREL
MACHINERY BUILDERS

POWER
PRESSES



ROLLING MILL
MACHINERY



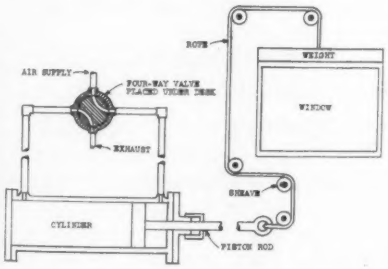
THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC.
Waterbury, Connecticut • U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

Executive Made Good Use of His Junk Pile—And Welding

Not so long ago one engineer called occasionally on the chief engineer of a large plant who believed in doing things the "easy" way—whenever possible. He was an exceptionally capable engineer, so much so that he became chairman of the board of the company.

★ ★ ★

During one of these calls the engineer found that it was not necessary for this chief to say, "George, close the window", or, "George, open the window" whenever he wanted the window opened or closed. The plant was so noisy that conversation over the telephone was impossible when the window was open. Consequently, the window had to be opened and closed frequently because the chief used the telephone often. The window was opened and closed by a twist of the wrist of the chief himself who simply manipulated a valve located beneath his desk within convenient reach. So the mere twist of the wrist—and compressed air — did it. The chief didn't rise from his chair or even bat an eyelash.



The chief told the boys in the plant to make such a device for him—and they did as per the accompany sketch—out of old cylinders, valves, and pipes and fittings that would otherwise have been junked. Modern welding can often do wonders with an old junk pile, as in this instance.

Do you have how-to-do-it items for this department? To make it a success we are depending on readers to send us material drawn from their own experience and observation. Your cooperation will be appreciated by us and our many readers.

Parts Tray with Adjustable Compartments Hooks on Pegboard

Hooked on pegboard above any working area, a new "Handee" tray provides a neat, easy way to keep track of small parts and tools. All items are at hand—where and when needed.

Each tray comes equipped with three adjustable dividers, but additional dividers may be used, since they are easily added and removed. Properly spaced hooks on the back of the tray make for easy pegboard placement. The tray measures 18 in. long, 3 in. wide and 2 in. deep, and has a curved bottom to make it easy to select parts for quick removal and use.

★ ★ ★

Of all-steel construction, this tray is spray-painted in a bright aluminum finish, or they may be painted to harmonize with any color scheme. In the home, factory or office, the Handee tray can eliminate wasted time and save frayed nerves.

—Courtesy of Industrial Marketing Service, Dearborn, Mich.

According To Nature Liquids Don't Flow In This Manner

Here are three sketches, all incorrect, that are typical of what we commonly see in publications every day. The error appears so often that this writer has decided to do something about it. The stream is shown as growing LARGER as it falls whereas, as a matter of fact, it grows SMALLER. Once in a while we see

actual photographs of streams of this kind and, of course, the photographs are correct. Give the matter a bit of thought and you will quickly understand WHY the stream grows smaller as it drops:

THE
WEST COAST REGIONAL MEETING

Thursday and Friday, June 4-5, 1959

FAIRMONT HOTEL, SAN FRANCISCO, CALIF.

A GOOD MEETING FOR WIRE MEN. ALL ARE CORDIALLY INVITED.

The Program

THURSDAY, JUNE 4

10:00 A.M.—Registration in the lobby of the Fairmont Hotel.

1:30 P.M.—Technical Session—for which six papers are scheduled.

PAPER: Bolt and Nut Specifications.

PAPER: Heat Treating of Steel Wire—Low and High Carbon.

PAPER: Storage and Shipping of Wire and Fabricated Wire Products.

(Coffee break)

PAPER: Heat treating from the Vendor's Standpoint.

PAPER: Plating of Wire and Wire Products (Baskets, etc.)

PAPER: Spring Wire—Bedding, Upholstery, Mechanical, etc.

The first three papers will be presented by wire mill men and the last three by men who are product manufacturers.

(Evening open)

FRIDAY, JUNE 5

9:30 A.M.—Busses will leave for a tour of Colorado Fuel & Iron Corporation's Wire Mills at South San Francisco. Luncheon will be served through the courtesy of C.F.&I. For the return trip, it is planned to take visitors back to the hotel via the scenic ocean highway.

6:30-7:30 P.M.—Hospitality Hour—Courtesy of several companies.

7:30 P.M.—The Dinner. An after-dinner speaker of note will address the gathering on the significance of guided missiles.

DOOR PRIZES, AS IN PREVIOUS YEARS, WILL BE GIVEN.

The Program Chairman of the 1959 meeting is LLOYD W. ALBRIGHT, Manager of Wire and Hardware Sales, Pacific Coast Division, Colorado Fuel & Iron Corp., Oakland.

Plan now to attend this meeting. Hotel reservations should be made direct with the Fairmont Hotel management.

One fee, $11.00 for members and $13.00 for guests, covers all charges.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**

Wire Kinks

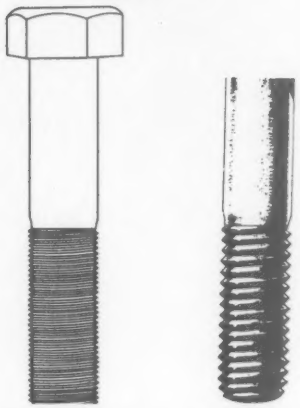
— because the velocity of the stream increases in strict accordance with the laws of gravity. When the liquid first leaves the opening its velocity is small. The cross-section of the stream must therefore be its greatest. In these sketches the cross-section is shown smallest. The cross-sectional area multiplied by the velocity gives the quantity of liquid flowing, as any mathematician will tell you.

★ ★ ★

After the liquid has fallen one foot, say, the time elapse is about ¼ of a second and the velocity is about 8 ft. per second. Therefore if the velocity at the opening is one ft. per second the cross-sectional area at the opening will be eight times as great as it will be at a point one foot down. Now let us go to a point 4 ft. down. The liquid will reach that point in a half of a second, and the velocity will be 16 ft. per second. In other words, the cross-sectional area will be one-sixteenth of the cross-sectional area at the opening. See how rapidly the stream becomes smaller? Yet in these sketches it becomes larger. Next time you do some pouring pay attention to this point. It is interesting, and sometimes it is important.

Coarse Threads Better Than Fine For Many Jobs

The load and stress concentrations on threads are lower in standard coarse thread fasteners than in fine threaded ones. Flank engagement is also greater because coarse threads are deeper. Except in such cases where fine adjustments are needed, coarse threads are, therefore, preferable to fine threads. They have greater resistance to stripping and, consequently, can be more highly



torqued to make a stronger assembly.

★ ★ ★

Coarse thread fasteners tighten with only two-thirds the revolutions needed for fine threads. So your assembly time is faster, too. Coarse thread bolts enter nuts or mating holes with less tendency to cross thread when not truly positioned. In hard-to-reach areas, this ease of starting can often be your deciding factor. Bear in mind, too, that coarse threads need less "babying" in handling since they're less apt to be damaged.

★ ★ ★

All in all, coarse threaded standard fasteners prove best for an assembly because of their additional clamping strength—and best for the assembler because of their extra economy and production advantages.

How Much Heat Does The Sun Give Off?

Now and then we all see statements regarding the heat given off by the sun, but we are not impressed because the figures are so enormous they are meaningless. One statement declares that, according to Smithsonian Institution calculations, the heat given off by the sun per year is equivalent to the burning of this many tons of anthracite coal: 400,000,000,000,000,000,000,000,000 tons.

★ ★ ★

Does that mean anything to you? Ask yourself this question: If the earth were made entirely of anthracite coal, and if the earth should then be used to feed the flames of the sun, how long would the earth last at the above rate of heat emission?

★ ★ ★

On the basis of 37.5 cu. ft. per ton for anthracite, it has been found that it would take 380 anthracite worlds to keep the sun going for one year because there would be that many worlds in the above huge tonnage of coal. All of which means that an anthracite earth would last only 0.96 of one day.

★ ★ ★

That seems to give us a more understandable picture of the heat given off by the sun. The earth would be completely burned up in about 23 hours.

How Much Is A Billion Dollars?

We have all heard and read about the true meaning of a billion dollars. No doubt you have been impressed, but have you ever looked at it in this way:—

★ ★ ★

Measure a dollar bill and you will find that it is 6-⅛ inches long by 2-⅝ inches wide. Get a billion of them and go to Manchester, Conn. Start laying a line of dollar bills end to end from Manchester,

(*Please turn to page* 632)

Jordan Wire Appoints Western Representative

Charles O'Rourke, President of **Jordan Wire and Cable Co., Inc.,** Jordan, New York, has announced the appointment of the **Paul I. Kenner Co.,** 230 Shaw Road, South San Francisco, Calif., as representative for Jordan Wire's line of conductors for the electrical and electronics trade throughout the state of California.

★ ★ ★

The Paul I. Kenner Co. operates as manufacturers' agent covering the western wire and cable trade exclusively and handles an extensive line of machinery and supplies for the wire trade in the Western United States. **Paul I. Kenner,** who has been associated with various phases of the wire industry for the past twenty years, is President of the company.

★ ★ ★

The appointment, effective March 1st, is another step in the steady expansion of customer service by Jordan Wire and Cable Co., Inc., one of the leaders in the wire drawing field, supplying the electrical wire and cable and related industries.

★ ★ ★

Jordan Wire and Cable offers the latest methods, combined with many years of experience, in the field of wire drawing, stranding, braiding, bunching, annealing, tinning, and silver plating of electrical copper conductors.

Paul I. Kenner

New Rubber-Like Material

A new rubbery plastic material that snaps back like rubber yet, unlike rubber, works without vulcanizing was described recently by **Dr. Waldo L. Semon,** director of polymer research, at **The B. F. Goodrich Company's** Research Center, Brecksville, Ohio.

★ ★ ★

Known as Estane VC, the tough, resilient, unvulcanized material, resists tearing and the effects of abrasion, solvents, oil and ozone—a unique list of properties for any rubbery material. Other rubbers, both natural and synthetic, before they undergo the costly, time-consuming process of vulcanization, have few of the qualities which later make them useful.

★ ★ ★

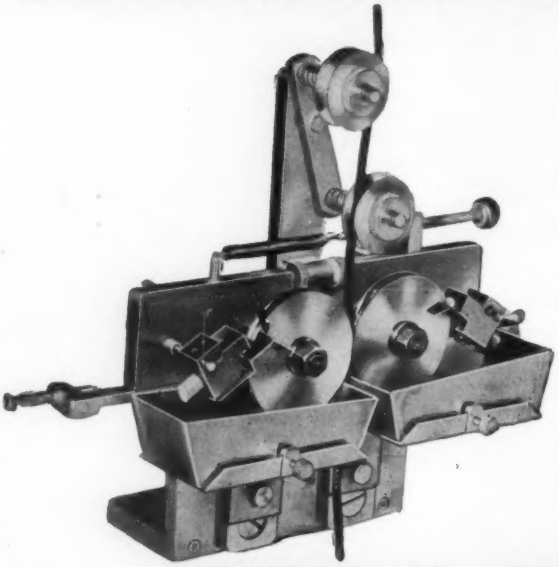
Estane VC, when deposited in

LEGEND LARGE AND CLEAR ON INSULATED WIRE SURFACES —— USE GILLIES MARKING

GILLIES CONCAVE AND FLAT MARKING WHEELS PRINT YOUR

WHEELS AND MACHINES FOR BEST WIRE IDENTIFICATION

MARKING WHEELS and MACHINES for ELECTRIC WIRE



Gillies Engraved Concave and flat marking wheels are widely used printing the I.P.C.E.A. color code, numerical, semi-spiral striped, dating, or manufacturer's identification, etc. on insulated wire, tubing or hose.

Machines print on ONE or BOTH SIDES in large legible letters. Wheels are adaptable to any machine—or we will supply the machines.

Wheels, shafts, ink pans and all accessories are readily removable for quick and easy cleaning.

Wheels are made of TOOL STEEL, HARDENED to Rockwell test 61-64 and HARD CHROME PLATED.

Send for samples of wire and prices on wheels and equipment.

"There is no substitute for QUALITY when combined with SERVICE"

DUNCAN M. GILLIES CO., INC.

P. O. BOX 181, WEST BOYLSTON, MASS.

Telephone: TE 5-4445

film form from a solvent, has a tensile strength of 7000 to 8000 pounds per square inch. This film may be redissolved in the specific solvent and redeposited in the form of another film with equal properties. No other known rubbery material has this unique property.

★ ★ ★

The first major application for Estane VC is expected in the field of wire and cable jacketing. Other potential uses include: Fuel hose, small-bore tubing, belting, coated fabrics, sheeting for equipment liners, engine mounts, valve diaphragms, pump components, and insulators. The new product is being produced in commercial quantities at a semi-works plant at the company's Avon Lake Development Center.

Impressions on Japan

Alvin N. Gray, who retired from Western Electric last Fall, went to Japan as a consultant late in 1958. His first letter giving his early impressions of the people and their activities is published in the belief that it will prove of interest to many of our readers.

Dear Editor:

A busy, bustling and crowded metropolis of more than 8 million people which is Tokyo is said here to be the world's largest city.

But the thriving manufacturing and port city of more than 1 million which is Yokohama will be my place of residence and headquarters for most of my work.

The miscellaneous traffic is strange in its assortment, but most strange because of driving on the left.

Undecypherable characters on the ubiquitous signs make it difficult for a "foreigner" to get about.

Free enterprise, particularly in merchandising, is like no place in the U. S. Supermarkets, yes, but different! Five blocks long and each department run by a different owner. The feeling is that every man or woman in Japan must run a business of some kind. Unending traffic of the most miscellaneous sort, loads well-secured, but apparently heavy for the vehicles.

Someone quoted Archimedes to the effect "Give me where to stand and a lever long enough and I will move the world." I would paraphrase that as "Give a Japanese two wheels and he will move Japan."

The three wheeled trucks, so far as I know are peculiar to Japan. They appear in sizes from motorcycle size up to an apparent 1½ ton rating. The driver sits on a motorcycle saddle in

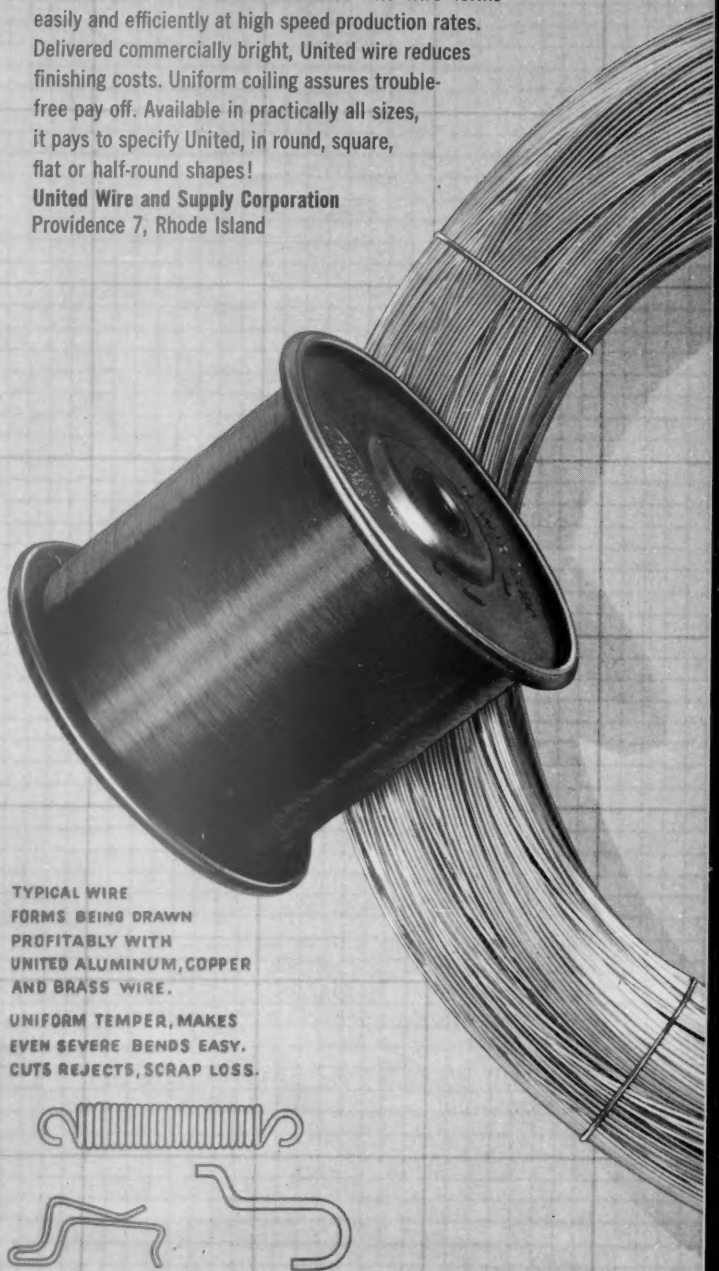
WHEELS AND MACHINES FOR BEST WIRE IDENTIFICATION

TOLERANCE

Reason why — it Pays to Specify
United Aluminum, Brass and Copper **Wire**

Drawn or shaped to your most exacting tolerance and temper standards . . . United wire fabricates into wire forms easily and efficiently at high speed production rates. Delivered commercially bright, United wire reduces finishing costs. Uniform coiling assures trouble-free pay off. Available in practically all sizes, it pays to specify United, in round, square, flat or half-round shapes!

United Wire and Supply Corporation
Providence 7, Rhode Island



TYPICAL WIRE FORMS BEING DRAWN PROFITABLY WITH UNITED ALUMINUM, COPPER AND BRASS WIRE.

UNIFORM TEMPER, MAKES EVEN SEVERE BENDS EASY. CUTS REJECTS, SCRAP LOSS.

For aluminum, brass and copper wire and tube
For silver brazing alloys . . . always **Specify**

Permanently United

UNITED

Wire Men Who Want **REEL** Economy

Think of **APCO MOSSBERG** first

It's simple arithmetic! There's little difference between first cost and *final* cost when you specify Apco Mossberg reels, spools and bobbins. Why? Because Apco's engineered all-steel construction lasts longer . . . is strong, safe, easy to handle!

Think, too . . . with each Apco Mossberg custom-designed unit, you get the *exact* balance and trueness you specify. Production-wise, Apco all-steel construction assures smooth spool-out without wire breakage or trapping . . . keeps downtime to the minimum . . . keeps your production rate up to date.

In every way, Apco Mossberg gives you *reel* economy that makes real sense. Wire, write or phone collect for preliminary recommendations. No obligation, of course.

PACIFIC COAST REPRESENTATIVE:
Gordon Proffitt
World Trade Center
Ferry Building
San Francisco 11, California

CANADIAN REPRESENTATIVE:
Hugh P. Williams & Co.
47 Colburne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

the center and steers with a pair of oversized handle bars, with his feet resting on the motor.

They seem so much more practical than the over-dressed pickup trucks and delivery vans in the U. S., which are half luxury auto and half truck. These vehicles are frankly delivery vehicles and are both less costly to build and operate.

Food is infinite in variety and excellent in flavor.

Fruits and vegetables are bigger, fresher and better flavored than at home.

Japanese soups please the most discriminating.

One gathers the impression that all Japanese cooks must be artists striving with each effort to render a masterpiece of color arrangement and flavor.

Strawberries grown in cold frames are luscious in appearance, enormous in size, and taste like strawberries every time.

Yokohama's wire and cable factory, big by any standards, turns out a line of products from 280 K.V. power cable to telephone wires and cables. A 400 K.V. plant is under construction.

Much equipment is modern and some archaic. My job is to impart a bit of the needed know-how to get more production from this equipment.

A pleasant two-hour train ride from Tokyo, lies another large mill at Nikko, a resort town in the mountains. It has a large electrolytic copper refinery, facilities for rolling rod and drawing of copper and aluminum, rolling aluminum sheet and extruding these two metals on a 3500 ton press. Here I will do some business too.

The managements of these plants, which are in a highly competitive field, appear not to be afraid to risk a few yen to investigate any reasonable possibility. Opportunities for improvement exist on every hand and engineers are eager for advice on any new approach.

Cold feed of rubber to extruders, autogeneous extrusion of plastics, and some improvements in machine design appear to be the first tasks to be tackled.

These are my early impressions of Japan and I look forward to the considerable work to be done.

ALVIN N. GRAY

New Cold Welding Tool

A rugged, new hand-operated bench model tool for cold pressure welding is announced by Koldweld. The new tool requires no current, heat or fluxes, yet produces a true weld by the Koldweld process, with physical and electrical properties of the joint equal to that of the parent metal.

★ ★ ★

The KBM-1 will handle from #18 AWG (.040″) to #8 AWG (.128″) aluminum wire and from #18 AWG to #9 AWG (.114″) copper wire.

★ ★ ★

In addition to aluminum and copper and their alloys, some brasses, lead, zinc, nickel, silver, palladium, platinum, gold and tantalum wires have been butt-welded to themselves and each other. Formex and enamel coated wire can be welded without removal of coating.

★ ★ ★

The KBM-1 is supplied with a rapid die-changing instrument that can also be used for extra die storage. Ease of operation is one of the many features of the tool. It can be mounted on a portable stand.

★ ★ ★

A brochure on the process and other tools is available by writing: Koldweld Division, The Kelsey-Hayes Company, Utica 4, N. Y.

Issues New Wire Rope Handbook

The availability of a new Wireco Wire Rope Recommendation Handbook for wire rope users has been announced by the **Wire Rope Corporation of America,** St. Joseph, Missouri.

★ ★ ★

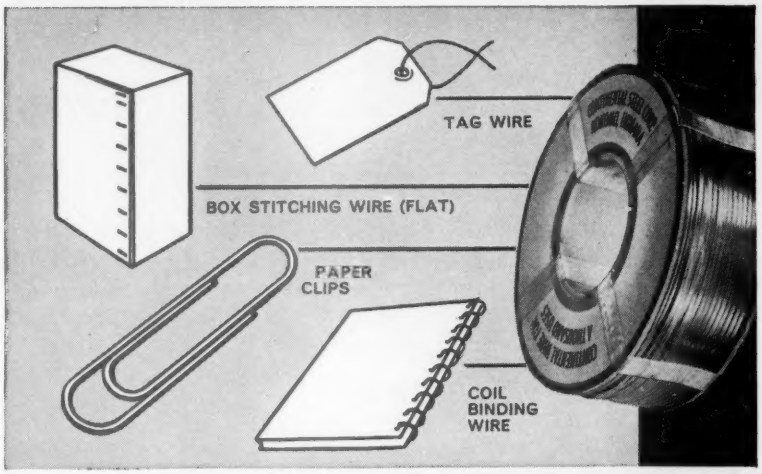
The Handbook, compiled by Wireco engineers, gives wire rope users a complete, basic working knowledge of the characteristics of different wire ropes and slings. It details uses in virtually all industries, and outlines how to select, order and use the correct wire rope to do a specific job.

★ ★ ★

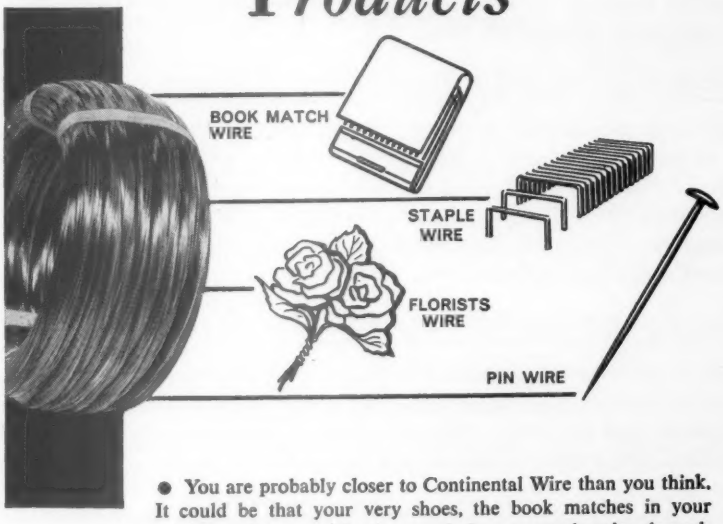
It is designed for use by engineers, contractors and builders and is indexed by: construction, drilling, industrial, marine and fishing, mining, logging, elevator and other allied fields using wire rope. It is concise and offers the user complete details on how to specify wire rope.

★ ★ ★

The Handbook is available free of charge to all wire rope users in the United States through Wireco distributors, representatives or the company. Others may purchase a copy by writing the Wire Rope Corporation of America, St. Joseph, Mo., price $1.00.



Fine and Specialty Wire for Super Fine Products



● You are probably closer to Continental Wire than you think. It could be that your very shoes, the book matches in your pocket or the paper clips in your desk—were made using dependable Continental Fine Wire! That's because Continental is preferred by hundreds of leading firms for literally thousands of different fine wire applications. For super fine products—you, too, should try Continental Fine and Specialty Wire, available in many sizes, of almost any temper, finish or analysis, in low carbon and medium low carbon steels.

For the finest in fine wire—call in Continental!

CONTINENTAL

STEEL CORPORATION • KOKOMO, INDIANA

Wire Specialists for over half a Century

PRODUCERS OF: Manufacturers' Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special shaped wire. Also Welded Wire Reinforcing Fabric, Nails, Continental Chain Link Fence, and other products.

EFFICIENT, MODERN SYSTEMS FOR ELECTRICAL WIRE & CABLE MANUFACTURING

• *CABLE LACQUERING SYSTEMS*

Conventional cellulosic, or other type, lacquers are applied in successive continuous coats from one to twenty-eight coats over fibrous braid wrapped primary conductors. One end, four ends, or eight ends of wire are handled continuously. System includes letoff, application, drying and constant tension takeup equipment.

• *WIRE ENAMELING SYSTEMS*

Natural and synthetic enamels, silicones, solution nylon, modified plastisol, and similar insulating coatings are applied to bare, cotton or glass covered wire in round, square or rectangular cross section. Ten or twenty simultaneous strands are handled. Systems are complete with letoff, preannealer, application system, capstan and multiple takeup unit.

• *ASBESTOS INSULATING SYSTEMS*

Carded asbestos is applied to continuous single conductor as an integrated operation with saturating, rotary forming, drying, cooling and polishing of the finished wire. Wire from No. 20 gauge to No. 6 AWG is handled through an asbestos wall thickness range of from .008″ to .040″ thickness in a single pass.

• *RUBBER OR PLASTIC JACKETING SYSTEMS*

Rubber and thermoplastic jacketing compounds are continuously applied to electrical wire or cable by the extrusion method. High speed, constant tension letoff and takeup equipment, controlled cooling or continuous vulcanizing equipment are powered by synchronized range drives as complete, integrated wire handling systems. Extrusion machines of customer's choice are furnished.

• *GLASS & VARNISH COATING SYSTEMS*

Double layer of glass or cotton wrapping is applied to round, flat or square conductor. Two individual coatings of high temperature varnish are applied and the finish baked in a continuous operation. Units are complete from letoffs to takeup frames.

• *SELF TRAVERSING REEL CORD DRYERS*

These ingenious machines are used to remove hygroscopic moisture from fibers, braided or knitted flexible cable. These machines increase extrusion speeds, reduce blister scrap loss and improve diameter control. They are easily installed in existing extrusion line.

TECHNICAL INFORMATION ON ANY OF THESE PROCESSES UPON REQUEST

C. A. LITZLER CO., INC.

235-239 BROOKPARK ROAD
CLEVELAND 9, OHIO

New Nylon Cable Clamps

New Panduit "Lok-Strap" Nylon Cable Clamps offer outstanding cost-saving features — starting with electrical equipment design and extending through purchasing, inventory, assembly, servicing and maintenance operations.

★ ★ ★

The "Lok-Strap" design incorporates a miniature quick-release tab which holds the band of the clamp securely and tightly around wires —but which opens instantly with a few ounces of fingertip pressure. This tab also allows almost infinite adjustment of the Cable Clamp or Tie to accommodate wire harnesses from ⅛″ to 2″ in diameter.

★ ★ ★

"Lok-Straps" are supplied in only one size—all that is required to replace a complete range of conventional cable clamp sizes. They can be opened, closed and re-adjusted repeatedly without damage, without special tools. Wires may be traced, added or removed from the harness quickly and easily at any time.

★ ★ ★

For complete information, write **Panduit Corp.**, Dept. WYP, 14461 Waverly Ave., Midlothian, Ill. Request descriptive Bulletin and sample.

New Cable Shield

Belden Manufacturing Company, Chicago, Ill., is featuring a new lightweight and more efficient shield, called Beldfoil®, for use with color TV camera cable, sound and intercom cables, and strain gauge cables.

★ ★ ★

Beldfoil combines the electrical conductivity of aluminum with the dielectric and mechanical properties of Mylar which results in a completely isolated, more efficient shield. It insures no cross talk and eliminates noises caused by external interference, and permits smaller diameter shielded cables and provides longer service life and greater dependability over a wider range of operating conditions.

Brings Out Two Nickel Silver Alloys

Two nickel-silver wire alloys have been introduced by **Bridgeport Brass Company** for varied uses, such as in screws and rivets, slide fasteners, camera and optical parts and costume jewelry.

★ ★ ★

The alloys are 18% and 12% nickel silver and are in addition to the company's 10% nickel silver wire alloy.

★ ★ ★

These alloys have excellent cold working properties and are readily formed, bent or cold headed. They are suitably joined by soft soldering, silver alloy brazing, resistance or exyacetylene welding.

★ ★ ★

A technical data sheet is available from Bridgeport Brass Company, 30 Grand St., Bridgeport 2, Conn.

Quality Control Men to Meet

The New England Conference Council, **American Society for Quality Control,** will hold its Twelfth Annual New England Quality Control Conference in Pittsfield, Massachusetts, at the Wendell Sherwood Hotel on October 30 and 31.

★ ★ ★

The program for this Conference has been developed to encompass a wide range of interests:

Seminars guided by top industrial consultants; Technical sessions presented by outstanding speakers; Education program taught by practicing quality control engineers.

These features combine to provide comprehensive coverage of the entire quality control field.

★ ★ ★

Thirty-two Technical Sessions will be offered during the Conference, of interest to the Engineer, Supervisor, and Inspector. Theory and practice have been combined to maximize lecture value. Don't miss this opportunity to up-date your **Quality Control Techniques.**

★ ★ ★

For details regarding this Con-

For Fungus Resistance, Specify

TEXTILENE TWI-TAR

Offering great durability along with light weight, Textilene Twi-Tar is successfully used for buried communication cable (bedding and overall serving), expanded ACSR cable (expander between core and conductors), stationary power cable and portable cables.

Twitchell's superior Textilene line also includes: Moisture-resistant fillers — *Twi-Flex* and *Twi-Wax*. Used for non-metallic sheathed cable, maritime shipboard cable, varnished cambric cable.

Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all types of portable and flexible cords.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation — also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

E.W. TWITCHELL INC.

Third and Somerset Streets, Philadelphia 33, Pa. • REgent 9-7800

PAPER PRODUCTS FOR THE WIRE INDUSTRY

Twisted • Folded • Pressed • Crushed • Shaped • Braided • Woven

WHY **KEEP** THE **UPKEEP?**

MAINTENANCE COSTS		TIME OUT
January	VERY HIGH	22 hours
February	STILL HIGH	17 hours

Switch to the

HKP® PORTER *Hydraulic* ONE-HOSE ROD and BAR CUTTER

IT'S PRACTICALLY . . .

MAINTENANCE FREE!

To slash those sky-high costs on bar and rod cutting operations and maintenance in your mill you need the superbly efficient, rugged, trouble-free one-hose PORTER HYDRAULIC ROD and BAR CUTTER. An all-job team of 3 Cutterheads and 5 Power Unit sizes offers just the right combination to handle any of your cutting work — faster better and at far lower cost. Here's why:

CONTINUOUS TROUBLE-FREE OPERATION

CUTTERHEAD PROTECTION — that eliminates constant "TIME OUT" and HIGH MAINTENANCE COSTS!

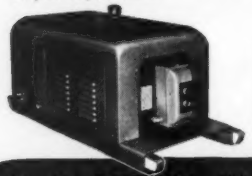
- **LONGER BLADES** with more bearing surface and rigid alignment eliminate side thrust and blade breakage.
- **FILTERED AIR** taken into the cylinder is forced out around the movable blade on each cut — eliminates the danger of dirt reaching bearing surface causing oil leakage and wear.
- **CONCENTRIC DESIGN** eliminates excessive wear of cylinder wall and ram.
- **LARGER CYLINDER AREA** allows the tool to cut capacity stock at a lower operating pressure, resulting in longer life for seal and hose.
- **SAFE, 12 VOLT CONTROL SWITCH** at the cutterhead gives instant finger-tip performance.
- **"KEY-POINT"** wear and replacement reduced to the minimum because of these exclusive HKP features.

A TRUE HYDRAULIC SYSTEM with these efficient, maintenance-saving features:

- **CONTROL VALVE** big and accurate enough for all industrial work. Solenoid operated.
- **EASY TO CHANGE RESERVOIR TYPE 10-MICRON OIL FILTER.**
- **PLUS** many other exclusive HKP features.

Ask to have a Porter Engineer tell you how the 3 CUTTERHEAD sizes and 5 HYDRAULIC POWER UNITS can provide the exact combination for your requirements.

OR — WRITE FOR COMPLETE PORTER HYDRAULIC ROD and BAR CUTTER FOLDER.



ATTENTION! Production and Quality Control Depts. Ask about our **NEW UPSET TESTING MACHINE!**

H. K. PORTER, INC. Somerville 43, Mass.

ference, please write: Carl W. Nikerson, % Wentworth Institute, Boston 15, Mass.

Booklet on Soldering Aluminum

Latest and most complete information available on the soldering of aluminum is presented in a new booklet by **Reynolds Metals Company.**

★ ★ ★

Newest addition to the Reynolds series of technical brochures, the handy-size reference includes data on soldering fluxes, irons and flames, and gives complete information on actual soldering methods such as hot plate, dip furnaces, friction, glass fiber brush and ultrasonic operations.

★ ★ ★

Types and properties of aluminum solders are explained, plus the corrosion of soldered joints and their performance in aluminum. Text is supported by diagrammatic illustrations.

★ ★ ★

Copies of "Soldering Aluminum" can be obtained by writing to Reynolds Metals Company, Dept. PRD-6, Box 2346, Richmond 18, Virginia.

Engis Hyprez Division Appoints Glen and De Carlo

Engis Equipment Company, Chicago, manufacturer of Hyprez Diamond Compounds, announces the appointment of two new distributors to cover the wire drawing and related fields.

★ ★ ★

Both these representatives, **Earle A. Glen** and **Steven DeCarlo** are well known and widely experienced in the wire drawing industry and in the tool, die and mold shops of the eastern and Atlantic states; they plan a stepped-up distribution and use of Engis Hyprez Division major products: Hyprez Diamond Compounds and accessories, and Di-Profiler Reciprocating Hand Machine with its assortment of diamond files, laps and other finishing tools.

★ ★ ★

Earle Glen, for thirty years a

leader in the wire drawing die field, recently organized **Glen Carbide, Inc.**, at 704 Second Ave., Pittsburgh 19, Pa. However, he will not represent Engis in the "Steel City", but in Ohio, Tennessee, the Carolinas, Georgia, Alabama, Florida, Virginia, West Virginia and the eastern half of Kentucky.

★ ★ ★

Steven DeCarlo will operate from his new Philadelphia headquarters: **Philadelphia Carbide Company**, Seventh and Cheltenham Ave. Mr. DeCarlo was associated for twenty-two years with Carboloy and for four years following with Allied Carbide. Steve is well known throughout the industry. He will sell the Engis line in Philadelphia and Southeastern Pennsylvania, Southern New Jersey and Delaware.

New Low-Cost Fault Locating Method

In the production of shielded two conductor, or multi-conductor cables including BX cable, final dielectric testing often discloses a fault which cannot be located exactly. The cable cannot be cut apart at the exact point of fault to enable the sale of the two parts. Previous attempts to do this resulted in many false cuts, so that cable was eventually cut up into many small pieces which were scrapped.

★ ★ ★

This total loss, particularly of teflon and other expensive cables, can now be prevented thru the use of a Peschel Cable Fault Locating Set, which has the following features:

(1) Locates faults quickly.
(2) Accurate to within ⅛" (minimum loss of cable length).
(3) Simple method requires no technical knowledge nor skill.
(4) Will not injure balance of cable.
(5) Inexpensive equipment.

★ ★ ★

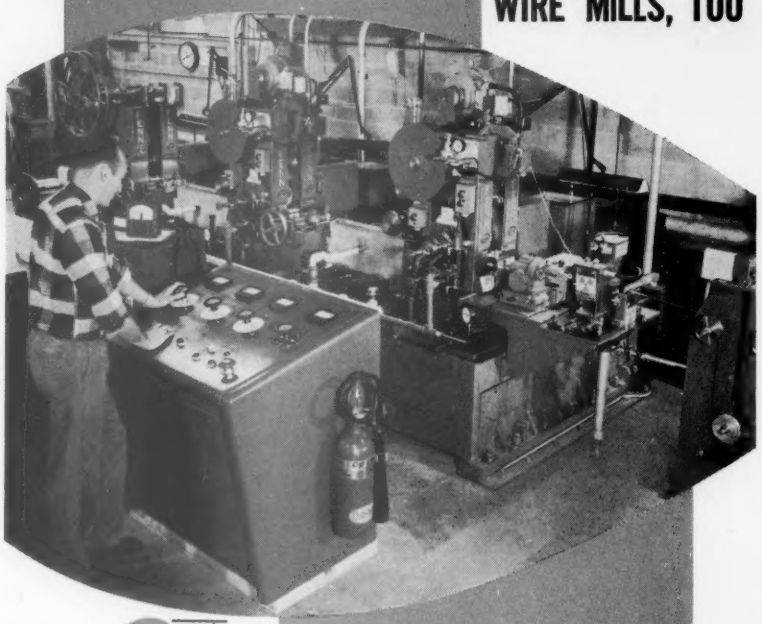
Peschel Cable Fault Locating Sets are available in several ranges for the various cables which normally require a dielectric test of from 3 KV or less, to 25 KV or higher.

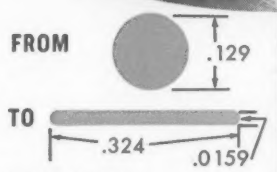
★ ★ ★

FENN

Sets the Pace

WITH PRECISION TANDEM COPPER WIRE MILLS, TOO

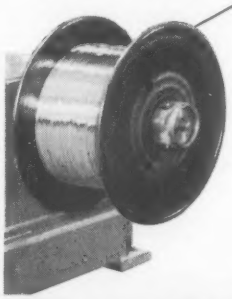




AT 1,000 FPM IN ONE PASS

to these precision tolerances

± .0005" on width
± .00005" on thickness
± .001" on radii of edges



This Fenn line exemplifies the finest in high speed precision wire flattening. It was engineered and built by Fenn to produce from an entry round thin copper tape with critical dimensions at continuous production speeds in excess of 900 fpm. The installation consists of a Fenn Model 082 three stand tandem mill with separate DC variable speed drives. Each stand has carbide shell rolls with both internal and external cooling. Between stands are Fenn No. 51 power-driven edgers and coolant troughs. Exit tape is automatically gaged by electro-limit width gage and Beta Ray thickness gage. Tension and speed synchronization are regulated by dancer roll controls between stands, and at exit end to synchronize the take-up reel which must traverse wind the tape with great precision for the next operation.

Fenn engineers welcome the opportunity to design and build precision mills and related material handling accessories and instrumentation to your exact product requirements. Fenn Wire Flattening Lines are production tested and proven. They incorporate advanced engineering features and versatility found in no other rolling mills. Fenn users enjoy the competitive advantages of greater production resulting from higher rolling speeds, and closer tolerances. Comprehensive catalog will be sent upon request.

THE FENN MANUFACTURING COMPANY • 602 FENN ROAD • NEWINGTON, CONN.

THE MOST COMPLETE LINE OF SPRING MAKING MACHINERY . . .

DESIGNED AND BUILT FOR THE METAL WORKING INDUSTRY

Sleeper & Hartley produce a complete line of spring-making machinery serving the basic metal working industries:

- **Fabricated Metal Products**
- **Instruments**
- **Ordnance**
- **Furniture and Fixtures**
- **Transportation Equipment**
- **Electrical Machinery**
- **Machinery (except electrical)**
- **Miscellaneous Products**

Quality and dependable service during 47 years of Sleeper & Hartley production have given the customer satisfaction for which we constantly strive.

No. 0 UNIVERSAL SPRING COILER, ESCAPEMENT TYPE. Series 720 — 73" Model.
This newest, versatile machine in the exclusive S&H escapement line incorporates the most advanced design engineering in the field, to give greater wire feed range and high speed production. Its many features include extremely accurate wire feed and controls for fine precision adjustment. Inertia is minimized since the only thing that starts and stops with this type feed mechanism is the wire itself.

Write for latest information . . .

SLEEPER & HARTLEY, INC., BOX 1249, WORCESTER 1, MASS., U.S.A.

Inquiries are invited. Send sample with fault and two good pieces will be returned with no loss in total length. Or, bring your bad cable and witness a demonstration of the method. Write or phone Peschel Electronics, Inc., Towners, Patterson, N. Y.

Handling Wire in Coils

Pettibone Mulliken Corp., 4700 W. Division St., Chicago 51, Ill., has developed a "Speed Swing Loader" for handling coils of wire that does this work faster and with less man-power.

★ ★ ★

One wire product manufacturer in Chicago previously had one man in a rail car to hook up the coils, another in a truck to unhook them and a third man to operate a crane.

★ ★ ★

With the PM Speed Swing Loader one operator now does the whole job at a saving of 60% over previous material handling costs.

★ ★ ★

Pettibone Mulliken will be pleased to send complete information on request.

Reynolds Appoints Western Distributor

The Silver Steel Company, Denver, Colo., has been appointed a distributor, it is announced by **L. duPont Yager,** vice president of **Reynolds Aluminum Sales Company.** Silver Steel has warehouses in Albuquerque, N. M. and Denver.

★ ★ ★

The firm will distribute Reynolds aluminum sheet, plate, extrusions, wire, rod, bar and other products in the Rocky Mountain area including Colorado, Wyoming, Utah and New Mexico.

★ ★ ★

President of Silver Steel is **Harold Silver** and **Frank Bowman** is vice president and general manager.

Outstanding Personalities of the Wire Industry

Harper Electric Names Two Representatives

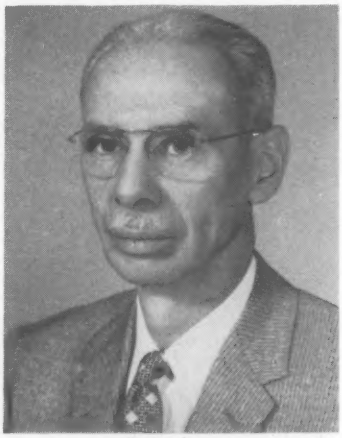
Roderick L. Harper, Executive Vice President of **Harper Electric Furnace Corp.,** Buffalo, has appointed **W. J. Sommers Co.,** 835 Englewood Ave., Buffalo 23, and **Arthur B. Sonneborn Co.,** 19983 Livernois Ave., Detroit, to sell the complete Harper line in their respective territories.

* * *

The Harper line includes furnaces for brazing, sintering, wire annealing, bright annealing, forging and electric kilns for a wide variety of operations.

Vaughn Appoints Jones To Head Wire Machine Development

The Vaughn Machinery Company has appointed **C. B. Jones,** former head of the **Lewis Machine Company,** to direct the development and marketing of a new line of wire straightening and cutting machines. The first machine in this field to be offered by Vaughn, the Vaughn MOTOMATIC, No. 75, has been completed and is in operation at the Company's Cuyahoga Falls, Ohio, plant.



C. B. Jones

* * *

Mr. Jones has been active in the wire machinery field for over 30 years, is a graduate of Case Institute of Technology and a member of **The Wire Association.** He operated his own sales company for many years, representing manufacturers of wire straightening and cutting machines, spring coiling and wire forming machines.

C. F. & I. Elects V. P. Eastern Div. Operations

Samuel A. Ott has been elected Vice President in charge of Operations, Eastern Division, **The Colorado Fuel and Iron Corporation,** by the Company's Board of Directors, **Alwin F. Franz,** President, has announced.

* * *

Mr. Ott, who was Works Manager of the company's Claymont

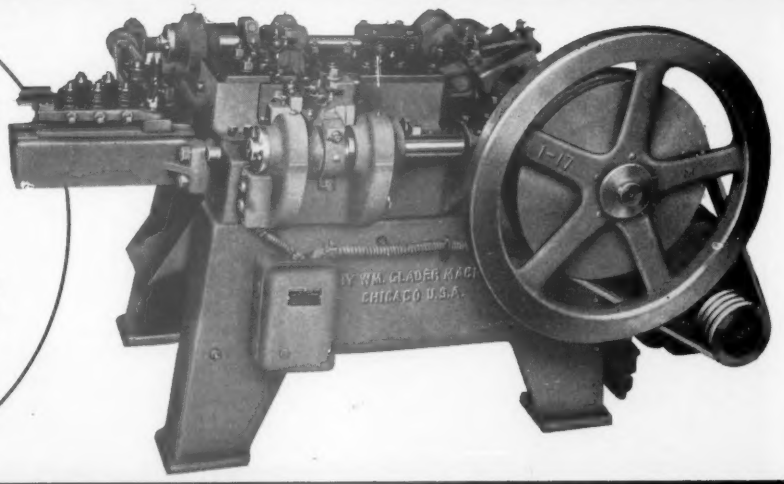
GLADER

HIGH SPEED WIRE NAIL MACHINES

HIGH TONNAGE OUTPUT — LOW MAINTENANCE COST

You can take care of increased production schedules and better product demands with these machines of established reputation.

For 55 years GLADER MACHINES have been giving HIGH QUALITY, LOW COST nail production.



Wm. Glader Machine Works 210 N. Racine Avenue Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

Division, has assumed his new duties. He joined CF&I in January 1956 as Works Manager of the Claymont Division. He was educated at Ohio State University.

★ ★ ★

Prior to joining CF&I, Mr. Ott was Superintendent of the Midvale Co., Philadelphia, Chief Metallurgist and assistant to the vice president at Pan-Ohio Steel Corp., Birdsboro, Pa., and Vice President and General Sales Manager of the Pittsburgh Alloy Corp. He began his professional career with the Follensbee Steel Corp., Toronto, Ohio, where he served as Superintendent of the Open Hearth.

AS&W Names Exec. V.P.

Elevation of **Harry M. Francis** to the position of executive vice president of the **American Steel and Wire Division** of **U. S. Steel Corp.** was announced in March by **Van H. Leichliter,** president of the Division.

★ ★ ★

In his new post Mr. Francis, who has been vice president-sales for the past 13 years, will coordinate activities of various departments of the Wire Division. He has been associated with American Steel and wire for over 43 years. He joined the Wire Division as a clerk in the mail department in 1915 while attending City College of New York. He advanced steadily and, over the years has occupied many important posts in the Wire Division.

★ ★ ★

Mr. Francis is succeeded by **Edward A. Murray,** who has been appointed Vice President-Sales. Mr. Murray joined the company in 1934 and, prior to this appointment, was Assistant Vice President-Sales. He was educated at Western Reserve University and recently attended the Advanced Management Program at the Harvard University Graduate School.

Harry M. Francis

Morgan Promotes Five In Rolling Mill Division

Philip M. Morgan, president of **Morgan Construction Company,** Worcester, Mass., has announced five promotions as part of an overall program of strengthening and improving the functions of the Rolling Mill Division of the Company.

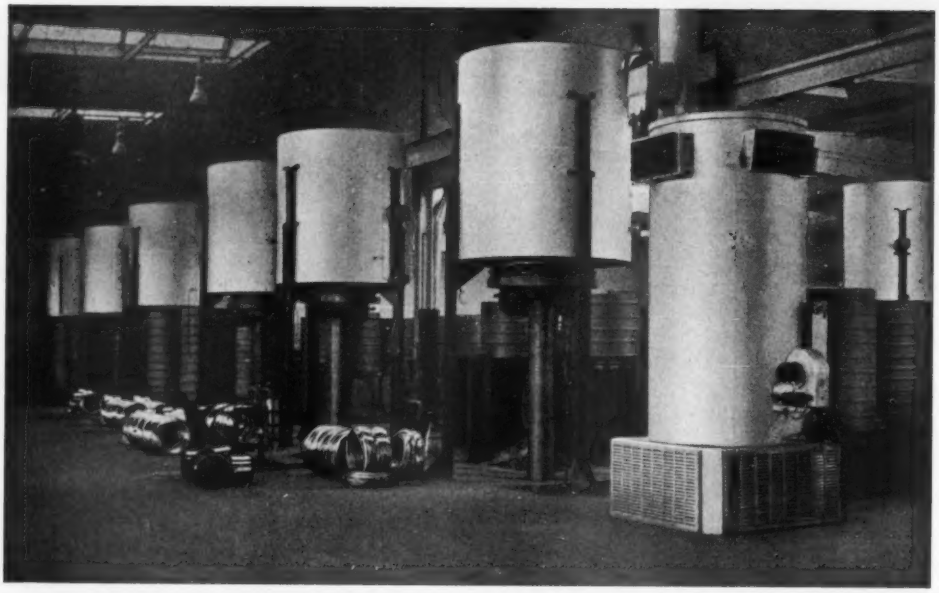
★ ★ ★

Edmund S. Murrah has been named director of engineering of the Rolling Mill Division. Mr. Murrah has served in various engineering capacities since joining Morgan's in 1945.

★ ★ ★

Roger Kinnicutt, Jr. and **William**

THE LAST WORD IN MODERN, EFFICIENT DESIGN!



SEVERAL VACUUM BRIGHT ANNEALING UNITS WHICH WE HAVE INSTALLED IN ONE OF THE MOST PROMINENT CABLE WORKS IN GERMANY

(German and Foreign Patents)

★

SOLE REPRESENTATIVE:
PAUL REICHER
Machinery & Equipment
P. O. BOX 127
Willowdale; Ont., Canada

OFENBAU **FRITZ** G.m.b.H. & Co. K.G. **HAGEN,** (W.-GERMANY)

J. Hill have been appointed assistant chief engineers to serve under Mr. Murrah. Both Mr. Kinnicutt and Mr. Hill were project engineers.

★ ★ ★

John H. Hitchcock has been appointed chief consulting engineer for all company divisions from his former post as chief mechanical engineer of the Rolling Mill Division. Mr. Hitchcock joined Morgan's as an engineer in 1933.

★ ★ ★

Bernard L. Burns has been appointed manager of a newly formed department designated as the Design and Development Department. Mr. Burns has been with the company since 1920, and before his new appointment held the post of assistant chief draftsman.

★ ★ ★

All new appointments were made under the direction of Morgan's first vice president, **Myles Morgan,** who heads the activities of the entire division.

★ ★ ★

The Morgan Construction Company developed the first continuous rolling mill in this country in 1888, and has continued to design and construct rolling mills and rolling mill equipment, with an impressive list of new designs and developments to their credit. Other products made by Morgan to improve and increase steel production are Morgoil roll neck bearings, Morgan-Isley Combustion Control Systems, Morgan-Connor Wire Machines, and Morgan Ejectors.

Carpenter Steel District Management Changes

The Carpenter Steel Company, Reading, Pa., has made three district supervisory changes in its eastern sales territories.

★ ★ ★

Robert P. Uhl, now district manager of New York, has had his responsibilities expanded to include the sales area served by the company's Bridgeport, Conn., warehouse. **Robert A. Kokat** has been promoted to district manager, Philadelphia, responsible for sales in the area served by the Philadelphia warehouse. **Aldridge E. Hunt, Jr.** has been appointed district manager, Hartford, Conn., and Providence, R. I.

Chase Names Philadelphia District Manager

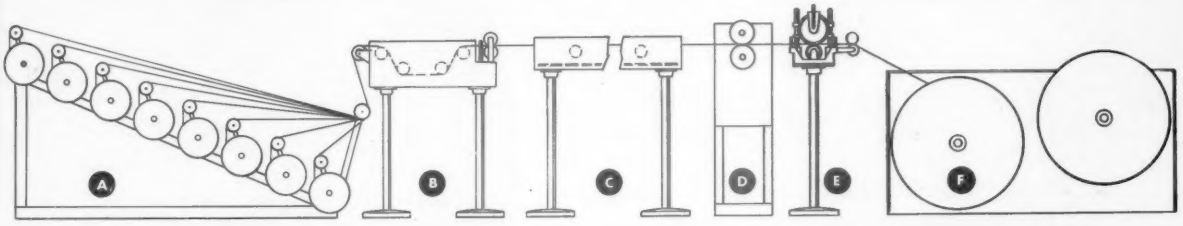
Promotion of **Howard N. Hartman** to district manager of **Chase Brass & Copper Co.** at Philadelphia, effective Mar. 1, was announced by **George B. Moseley,** vice president-sales. He succeeds **Willard M. Brown,** a veteran of 32 years with Chase, who retired Mar. 1.

★ ★ ★

A native of Minneapolis, Minn., he graduated from Ohio State University in 1948. Joining Chase in Feb. 1952 he was sent to Cleveland as a salesman. In 1956 he was transferred to Philadelphia as a salesman, the post he leaves to become district manager.

★ ★ ★

ANOTHER "FIRST" BY ENJACO!...



Our Brand-New RIBBON CABLE EQUIPMENT!

This long-needed "package unit" is designed to perform the complete assembly of multiple wires into flat, ribbon cable containing up to 16 conductors, or more if required.

The equipment consists of Tension-Controlled, Multi-Head Pay-Off (A), Coating Tank (B), Drying Oven (C), Adjustable Constant F.P.M. Capstan (D), Measuring Machine with Predetermined Counter (E), and a Double-Head Pancake Coiler with Torque Control (F).

ASK FOR CATALOG SECTION 2E-1

ENJACO CORPORATION

JAMES L. ENTWISTLE, President
THOMAS L. HOLMES, Vice President

100 GLEN ROAD, CRANSTON 10, R. I., U.S.A.
MAIL, P.O. BOX 3674 • PHONE HOPKINS 7-8411
CABLE "JALENCO" PROVIDENCE

EUROPEAN REPRESENTATIVES:
General Engineering Co. (Radcliffe) Ltd.
Station Works-Bury Road
Radcliffe, Lancashire, England

WESTERN REPRESENTATIVES:
Paul I. Kenner Co.
230 Shaw Road
South San Francisco, Cal.

Willard M. Brown was born in Toledo, O., and is also a graduate of Ohio State U., class of 1916. He had worked as chief metallurgist for the Detroit Copper and Brass Rolling Mill for several years prior to coming to Chase in 1927 as a salesman in Detroit. He subsequently filled several executive sales positions for Chase in Cleveland before his appointment as manager of their Washington, D.C. office. He left this position in 1952 to accept the post of district manager at Philadelphia.

★ ★ ★

He is married to the former Catherine Metzler, and the Browns have two children, Willard H., and Mrs. David T. Whitcomb.

ASM Appoints New Director

Appointment of **Allan Ray Putnam** as managing director of the **American Society for Metals** was announced on March 30th by **Dr. Clarence H. Lorig,** president of the 30,000-member metals engineering society.

★ ★ ★

As managing director of the Metal Society, Mr. Putnam will occupy a new position established by the ASM Board of Trustees following the death last May of **William H. Eisenman,** a founder-member of the Society and its well-known national secretary and executive head for 40 years.

★ ★ ★

Mr. Putnam comes to the American Society for Metals from Detroit where he has been assistant executive secretary of the **American Society of Tool Engineers.** He will assume his new ASM position in Cleveland as soon as his present commitments are concluded.

★ ★ ★

Mr. Putnam was graduated in 1942 from the Wharton School of Finance and Commerce of the University of Pennsylvania with a degree in economics. Following four years in the Army Air Force as a captain, he joined the American Electroplaters Society as business manager.

★ ★ ★

In 1949 the American Society of Tool Engineers appointed him assistant executive secretary and publisher of "The Tool Engineer".

Reappointed Electrical Products Industry Finance Chairman

Robert C. Bennett, Jr., General Manager of **H. K. Porter, Inc., National Electric Division,** Porter Building, 601 Grand Street, Pittsburgh, Pa., has been reappointed to serve as Finance Chairman of the Electrical Products Industry for 1959 for the United States Committee for the United Nations.

★ ★ ★

The United States Committee for the United Nations, now in its eleventh year of activity, is a privately supported citizens organization whose Chairman is appointed annually by the President of the United States. Working through 120 voluntary national organizations, the purpose of the Committee is to "arouse interest in, disseminate facts about the United Nations and to promote the

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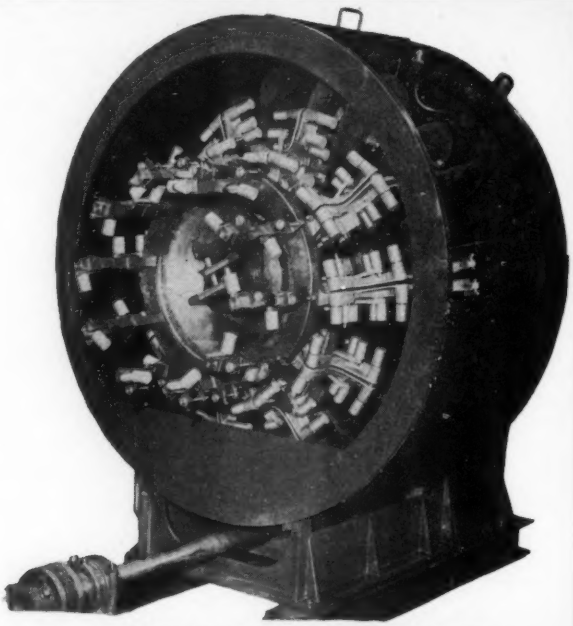

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observance of United Nations Day in the United States."

Riverside-Alloy Appoints District Manager

The appointment of **Robert G. Clark** as district manager of the New York territory has been announced by **F. H. Conant,** General Sales Manager of **Riverside-Alloy Metal Division, H. K. Porter Company, Inc.**

★ ★ ★

Mr. Clark has been with the division since 1941. He will direct Riverside-Alloy's sales efforts in the area of New York City and northern New Jersey. His offices will remain at 19 Washington St., East Orange, N. J.

G. E. Metallurgical Products Dept. Has New G.M.

Dr. Charles E. Reed has been named general manager of **General Electric Company's Metallurgical Products Department** in Detroit, it was announced by **R. L. Gibson,** vice president and general manager of the Chemical and Metallurgical Division of that company.

★ ★ ★

He succeeds **Kenneth R. Beardslee,** who, as general manager since 1951, led the Detroit General Electric unit to a prominent position nationally in the manufacture of several products. Mr. Beardslee has become a consultant for the Department. He currently is in Europe investigating manufacturing techniques, distribution and use of permanent magnets, cemented carbides and industrial diamonds.

★ ★ ★

Dr. C. E. Reed K. R. Beardslee

A Massachusetts Institute of Technology graduate with a doctor of science degree in chemical engineering and former assistant professor of chemical engineering there, Dr. Reed has been general manager of the Silicone Products Department of General Electric, Waterford, N. Y. for the past seven years.

★ ★ ★

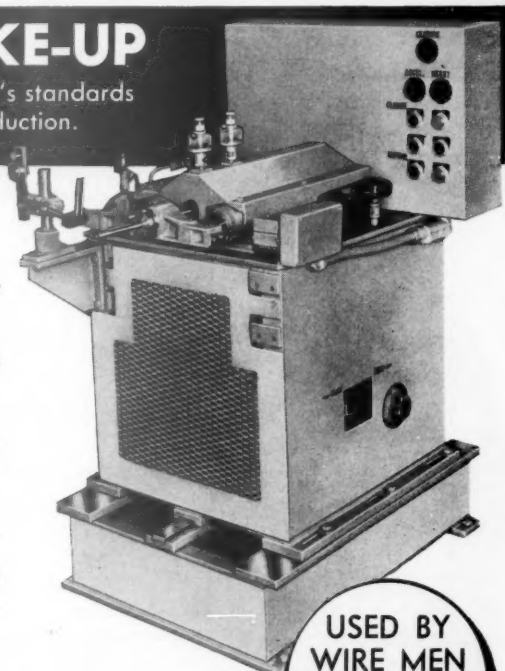
He joined General Electric as a research associate in the Research Laboratory in Schenectady, later heading the chemical engineering organization of that laboratory. He became manager of the Chemical Engineering Department in 1945 and general manager of the Silicone Products Department in 1952.

★ ★ ★

Formerly the Carboloy Department of General Electric, the Metallurgical Products Department employs some 1650 persons and manufactures Carboloy cemented carbides used in wire drawing dies, cutting tools, mining tools, Gener-

Sjogren FLAT WIRE TAKE-UP

This new SJOGREN machine is designed to meet today's standards for trouble-free operation and long-run wire mill production.



FEATURES INCLUDE:

SPEED — Presently running 650 fpm.

CAPACITY — 25 pound maximum capacity spool. (Similar models for heavier capacity).

TRAVERSE — Hydraulic spool traverse is infinitely adjustable from zero to 5/8" per rpm of spool.

TENSION — When placed directly behind flattening mill, constant tension is maintained through a Louis-Allis eddy current clutch type motor.

STARTING — Forced acceleration circuit prevents slack wire.

BASE — Machined so that top unit may be moved to compensate for wear on the flattening mill roll.

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al Electric vacuum melted alloys and the widely-known man-made diamonds.

Reynolds Elects New Vice Presidents

Ernest W. Schaw and **Fritz L. Sargeant** of **Reynolds Metals Company,** general managers of the southeastern and south central sales regions respectively, have been elected vice-presidents of **Reynolds Aluminum Sales Company.** The promotions were announced by **David P. Reynolds,** executive vice-president of Reynolds Metals Company, the parent firm.

★ ★ ★

Mr. Schaw joined Reynolds in 1935 as a mail boy in the company's New York office and later became a salesman. He became district sales manager for Boston in 1944 and for Cincinnati in 1947. In 1951 he became manager of the company's sales in the southeastern region, with headquarters in Camden, N. J.

★ ★ ★

Mr. Sargeant joined the company in 1941, in purchasing and traffic assignments connected with construction of the firm's first primary reduction plant at Listerhill, Ala. Then he took up production control duties, first at Listerhill and later at the Louisville, Ky. extrusion and reclamation plants. In 1944 he entered industrial sales as district manager in Kansas City, moving up to divisional manager in New York in 1948. He was promoted to his present position in the southeastern region in 1952, with headquarters in St. Louis.

New Mill Product Sales Manager

The Carpenter Steel Company, Reading, Pa., has appointed **Avard W. Taylor** as General Sales Manager, Mill Product Division, according to an announcement by **H. Sturgis Potter,** vice president—sales. He will have his headquarters at the main Reading mill.

★ ★ ★

Prior to this recent appointment, Taylor was associated with Carpenter as sales representative, assistant branch manager and district manager of the Philadelphia territory. During approximately the past year and a half he has been district manager of the company's Philadelphia and Atlanta territories. He is a graduate of Pennsylvania State University.

To Sell Silicones in Southeast

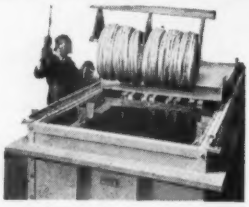
The Silicone Products Department of the **General Electric Company** has recently announced the opening of a new Southeastern Sales Territory. **Joseph V. Rizzo,** formerly assigned to the Department's Newark Office, has been placed in charge of this territory. Until a new sales office is established, Mr. Rizzo will be located in the Silicone Sales Office, 1000 Tuckaseegee Road, Charlotte, N. C.

★ ★ ★

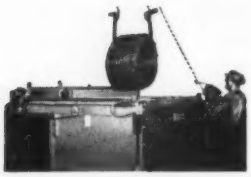
A 1953 graduate of the Newark College of Engineering with a Bachelor of Science degree in chemical engineering, Mr. Rizzo joined General Electric in August, 1955, after serving two years with the U. S. Navy.

U.S.I. Appoints General Manager

Clifford E. Oman has been appointed Tuscola General Manager for **U. S. Industrial Chemicals Co.,**



TYPICAL — The Ajax installation at right treats 1000 lbs. of aluminum alloy wire an hour. It is also used for annealing brass and copper wire and for stress relieving cold headed C1008 ½" steel rods. (Lower left) 700 lb. charges of steel wire are brought to annealing temperature in less than 15 minutes, clean, scale-free and without decarburization.



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SALT
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furnaces

WRITE FOR case history bulletins on ☐ Process Annealing; ☐ Descaling; ☐ Patenting; or ☐ Cleaning, Preheating or Fluxing. These describe actual Ajax salt bath installations and actual wire processing results obtained.

AJAX ELECTRIC COMPANY
928 FRANKFORD AVENUE., PHILADELPHIA 23, PA.

Division of National Distillers and Chemical Corp., it has been announced by **Robert H. Cornwell,** Production Vice President. In his new position, Mr. Oman assumes responsibility for operations at the big petrochemical plant-complex at Tuscola, Illinois, where the company produces polyethylene, ethyl alcohol and many other chemical products.

* * *

In 1951, Mr. Oman joined National Distillers as an Area Superintendent and was serving as Assistant Plant Manager at the time of his new appointment. He holds a Bachelor of Chemical Engineering degree from the University of Minnesota.

G. E. Appointment Announced

Thomas J. March has been appointed Manager-Sales for the **Silicone Products Department, General Electric Co.,** Waterford, N. Y., by **J. T. Coe,** marketing manager. He succeeds **John T. Castles** who has become general manager of the Chemical Development Operation of the company's Chemical & Metallurgical Division. Mr. March is a graduate of the Illinois Institute of Technology with a B.S. degree in electrical engineering.

Reynolds Advances Lipkowitz

Irving Lipkowitz has been named to the newly created post of director of economic affairs, **R. S. Reynolds,** president of **Reynolds Metals Company,** has announced.

* * *

In announcing the new assignment, Mr. Reynolds said the director of economic affairs, as the company's principal economist, would be responsible for economic studies in the areas of competition and world trade.

* * *

Mr. Lipkowitz joined Reynolds Metals Company in January 1947 as economic advisor to **R. S. Reynolds,** founder of the aluminum firm. Since 1949 he has also served as assistant to the president and as director of economic research.

Two Sales Positions Created by AS&W

Creation of two new executive sales positions with **American Steel & Wire Division** has been announced by **Edward A. Murray,** newly appointed sales vice president for this U. S. Steel unit.

* * *

Promoted to the post of manager of distribution and availability was **M. E. Capouch** and advancing to the assignment of manager of marketing was **William H. Guterl.**

Mr. Capouch will direct the Division's product sales programs as well as distribution facilities, including warehouses, throughout the country, and Mr. Guterl, in his new capacity will direct such specialized functions as advertising, market development and commercial research as well as product planning and development for the Sales Department.

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The NORBIDE* abrasive this operator is using assures extra efficiency plus extra economy in refinishing wire drawing dies. Next to diamonds and diamond dust this Norton-developed grain is the hardest manufactured abrasive commercially available — yet its cost is 300 times less than sized commercial diamonds.

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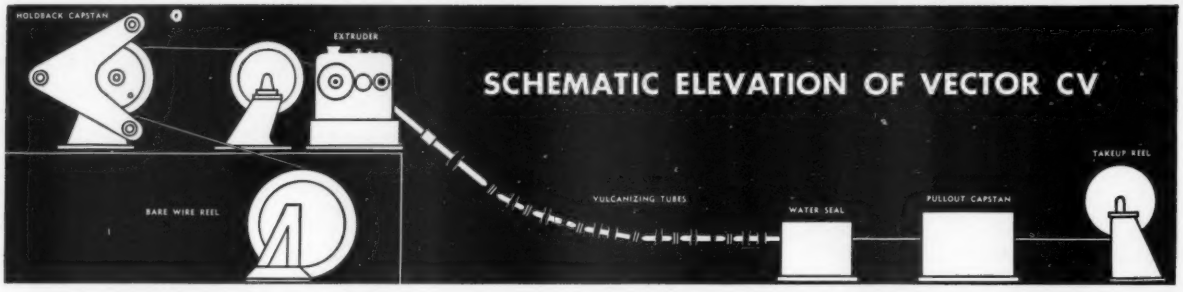
AIS 10

JANUARY - 1959
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Item	Current Month 1959 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1958) Percent of Total Shipments	Year to Date 1959 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1958) Percent of Total Shipments
Ingots and Steel Castings	1A	8,977	9,010	1,671	19,658	0.3	0.5						
Blooms, slabs, billets, sheet bars	1B	86,692	37,574	1,603	125,869	2.0	2.2						
Tube rounds	1C	1,599	476	3	2,078	-	-						
Skelp	2	10,282	-	-	10,282	0.2	0.1						
Wire rods	3	86,844	2,171	729	89,744	1.5	1.2						
TOTAL SEMI-FINISHED		194,394	49,231	4,006	247,631	4.0	4.0						
Bars—Hot rolled (incl. light shapes)	14	477,092	142,864	3,269	623,225	10.1	9.0						
Bars—Reinforcing	15	134,331	-	-	134,331	2.2	2.3						
Bars—Cold finished	16	96,758	21,700	4,325	122,783	2.0	1.7						
Tool steel	17	819	6,726	-	7,545	0.1	0.1						
TOTAL BARS AND TOOL STEEL		709,000	171,290	7,594	887,884	14.4	13.1						
Wire—Drawn	23	209,978	3,180	2,284	215,442	3.5	3.5						
Wire—Nails & staples	24	30,380	-	1	30,381	0.5	0.6						
Wire—Barbed & twisted	25	3,960	-	-	3,960	0.1	0.1						
Wire—Woven wire fence	26	11,315	-	-	11,315	0.2	0.3						
Wire—Bale ties & baling wire	27	7,337	-	-	7,337	0.1	-						
TOTAL WIRE & WIRE PRODUCTS		262,970	3,180	2,285	268,435	4.4	4.5						
Sheets—Hot rolled	31	703,509	25,325	2,183	731,017	11.8	9.8						
Sheets—Cold rolled	32	1,322,809	5,697	10,400	1,338,906	21.7	16.7						
Sheets—Galvanized	33	279,244	-	-	279,244	4.5	3.6						
Sheets—All other coated	34	26,103	-	-	26,103	0.4	0.3						
Electrical sheets & strip	35	3,014	47,188	-	50,202	0.8	0.7						
Strip—Hot rolled	36	108,291	2,029	825	111,145	1.8	1.6						
Strip—Cold rolled	37	91,231	1,491	18,678	111,400	1.8	1.8						
TOTAL SHEETS AND STRIP		2,534,201	81,730	32,086	2,648,017	42.8	34.5						
TOTAL SHIPMENTS (1959)		5,734,194	401,409	50,565	6,186,168	100.0	xxx						xxx
TOTAL — PRIOR YEAR (1958)		4,863,518	310,344	41,555	5,215,417	xxx	100.0					xxx	



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VECTOR CV with special new double seal combines the advantages of horizontal and vertical CV without the disadvantages of either. Check these important features:

- **QUALITY**—wire and cable is completely supported externally to prevent scuffing and distortion.
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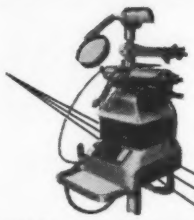
COPPER - Consumption of refined copper in the United States, November-December 1958, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
November:						
Cathodes	351	8,790	(3)	72	(3)	9,213
Wire bars	70,838	4,835	(3)	-----	(3)	75,673
Ingots and ingot bars	762	8,860	(3)	200	(3)	9,822
Cakes and slabs	-----	10,399	(3)	-----	(3)	10,399
Billets	-----	12,008	(3)	-----	(3)	12,008
Other	92	-----	(3)	86	(3)	178
Total	72,043	44,892	(4)	358	(4)	4/120,293
December:						
Cathodes	488	8,898	(3)	48	(3)	9,434
Wire bars	71,274	4,638	(3)	-----	(3)	75,912
Ingots and ingot bars	976	11,162	(3)	167	(3)	12,305
Cakes and slabs	-----	11,841	(3)	-----	(3)	11,841
Billets	-----	12,083	(3)	-----	(3)	12,083
Other	84	-----	(3)	34	(3)	118
Total	72,822	48,622	(4)	249	(4)	4/124,693

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.



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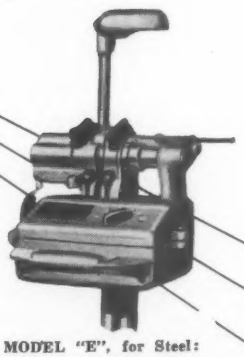
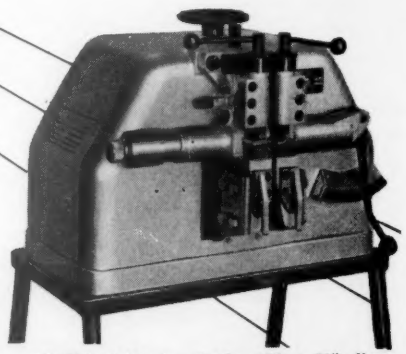


MODEL "E", for Steel: .04" - .32" diam. Copper: .04" - .25" diam.

Our range includes:
BUTT — SPOT — SEAM AND SPECIAL PURPOSE WELDERS



MODEL "M", for Steel: .16" - .51" diam. Copper: .16" - .37" diam.

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Recent Actions of ASTM On Electrical Materials

Conductors

Emphasis in the conductor field is toward the use of more aluminum to supplement copper which continues to be in short supply. Specifications for aluminum communication cable have been approved and published. Also a number of standards dealing with copper conductors have been revised and brought up to date.

Insulation

In the insulation field, Committee D-9 on Electrical Insulation is paying particular attention to problems relating to corona measurement, arc tracking resistance of insulation, thermal stability, as well as special problems relating to test methods for printed circuit materials, particularly copper-clad thermosetting laminates. Methods have been published as information on corona measurement and arc tracking. The committee is planning a research project in cooperation with NEMA and EIA directed toward solving some of the problems of specimen preparation and electrical measurements on copper-clad laminates.

Insulated Wire and Cable

The subcommittee on magnet wire of Committee D-9 continues an active program toward the development of test methods for magnet wire insulation. One problem in particular is that of compability of the insulation with refrigerants as used in hermetically-sealed refrigeration units. So far no standards in the field have been recommended for publication.

★ ★ ★

Efforts of the wire and cable sub-committee of Committee D-11 on Rubber and Rubber-Like Materials are being applied to the development of specifications for silicone rubber insulation; synthetic rubber, heat-resisting, and moisture-resisting insulation.

—Courtesy of the ASTM Bulletin

Fastener Mill To Expand Plant

Butcher & Hart Mfg. Company, Altoona, Pa., manufacturers of Quality Industrial Fasteners, has announced plans to expand its plant approximately 50%.

★ ★ ★

The major part of the machinery will be used for the conversion of Hot Rolled Rods into Cold Drawn material. The installation will be unique in the Industry and encompasses the most modern practices and handling methods.

★ ★ ★

Substantial Hi-Speed additions are also being made to existing equipment, better enabling production to meet the increasing demands for B&H Products. Further integration of operations also will broaden Plating and other departments.

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#108

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,875,508, METHOD OF WINDING ARMATURE CORES IN AN APPARATUS, patented March 3, 1958 by Cecil Farmer, Pawtucket, R. I.

The method includes dividing the wire into a number of doubled wire portions of equal lengths and equal in number to the number of grooves in the core, anchoring the wire portions extending between each doubled portion with reference to the armature at one end portion thereof, thence inserting the lengths of double wire portions each into a separate groove of the core, thence continuing the winding of the trailing doubled portions into their respective grooves so as to complete the winding of the wire in coils in the grooves, then severing the wire at the anchored portions thereof.

★ ★ ★

No. 2,875,561, METHOD OF PACKAGING COILS OF LONGITUDINALLY EXTENDING MATERIAL, patented March 3, 1959 by John Taynton Davy Spence, Kidderminster, England, assignor to The National Standard Company, Limited, Kidderminster, England, a British company.

In packaging wire on a reel, the inventor places a one piece tubular sleeve or elastic airtight material over the reel so that the central portion of the sleeve fits snugly around the core of the reel and the end portions of the sleeve are stretched across the internal surfaces of the reel flanges, then winds the wire on to the sleeved reel, folds the two ends of the sleeve towards each other into overlapping relation over the outer layer of the wire on the reel and finally provides an airtight seal between the overlapped ends of the sleeve.

★ ★ ★

No. 2,875,725, WIRE COATING DEVICE, patented March 3, 1959 by Harry B. Lit and Richard P. Anderson, Pittsfield, Mass., assignors to General Electric Company, a corporation of New York.

More specifically the device is adapted to coat wire of rectangular cross section. There are 6 claims.

★ ★ ★

No. 2,875,894, NAIL MACHINE WHISKER SEPARATOR, patented March 3, 1959 by John F. Nelson, Concord, Calif., assignor to United States Steel Corporation, a corporation of New Jersey.

Included are a number of novel rake flights spaced circumferentially around the inside of a tumbler for propelling the nails through the interior of the tumbler.

★ ★ ★

No. 2,876,146, SURFACE TREATING ROD, WIRE AND THE LIKE, patented March 3, 1959 by Ruben O. Peterson, University Heights, Ohio, assignor to The Osborn Manufacturing Company, Cleveland, Ohio, a corporation of Ohio.

There are 27 claims to this patent to methods and apparatus for surface conditioning a travelling length of wire by directing it in an arcuate path and simultaneously brushing opposite sides of the wire at an angle without twisting it.

★ ★ ★

No. 2,876,493, DEVICE FOR GUIDING WIRES HAVING PARTS ATTACHED THERETO, patented March 10, 1959 by Frank A. Schultz, La Grange, and James R. Waldron, Chicago, Ill., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The device is for association with apparatus having a pair of cooperable dies for molding successive relatively thin parts in spaced relation to each other onto a number of parallel wires intermittently advanced longitudinally between the dies.

★ ★ ★

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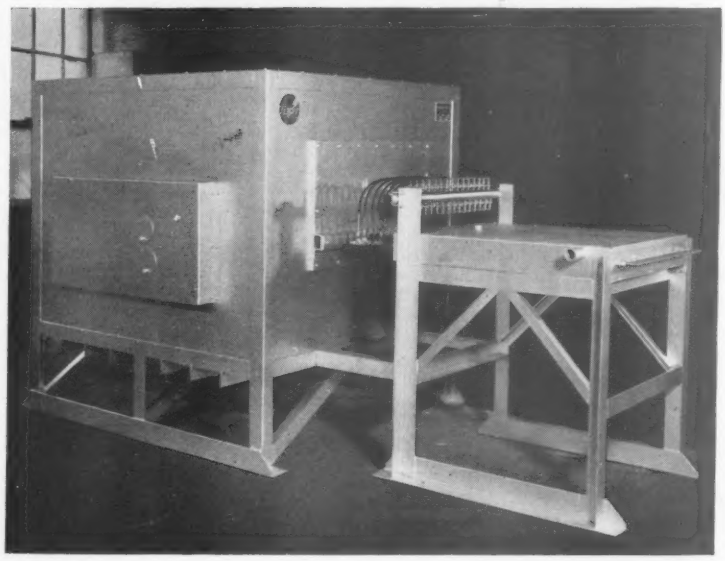
delivers bright stainless wire continuously at high speeds



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ELECTRIC FURNACES

No. 2,876,517, FASTENING DEVICES, patented March 10, 1959 by Menloe L. Stanley, Dallas, Tex.

A wire fastener is disclosed comprising a bent length of wire. Seven claims.

★ ★ ★

No. 2,876,534, METHOD FOR THREADING WIRES THROUGH INSULATION, patented March 10, 1959 by Salvatore J. Savona, Alhambra, Calif., assignor to Lockheed Aircraft Corporation, Burbank, Calif.

More specifically, this method is directed to running an elastic tubing over a wire bundle.

★ ★ ★

No. 2,876,761, HELICOIDAL STONE-SAWING WIRE, patented March 10, 1959 by Roger W. Stevens, Woodbury, Conn., assignor to United States Steel Corporation, a corporation of New Jersey.

A helicoidal saw wire is disclosed consisting of a metal strip having a portion of reduced thickness intermediate the side edges thereof and extending discontinuously along its length, the strip being twisted about its longitudinal axis to form helical grooves along its length.

★ ★ ★

No. 2,877,620, WIRE TWISTING MACHINE, patented March 17, 1959 by Sidney B. Blaisdell, East Greenwich, R. I., assignor to Edmands Company, a corporation of Rhode Island.

Among the objects of the invention are to maintain a constant tension on the wires as drawn from the reels as well as to arrest the turning of the reels upon breaks in the wires.

★ ★ ★

No. 2,877,807, COIL WINDING APPARATUS FOR ODD-SHAPED COILS AND THE LIKE, patented March 17, 1959 by William G. Robertson, Toronto, Ontario, Canada, assignor to Rotronic Corporation Limited, Toronto, Ontario, Canada.

Coils of odd shapes may be wound by this apparatus, such as saddle-shaped coils for deflection yokes. Ten claims.

★ ★ ★

No. 2,877,808, WIRE-TYING MACHINE, patented March 17, 1959 by Harold K. Embree, Hamilton, Ontario, Canada, assignor to Ovalstrapping Inc., Hoquiam, Wash., a corporation of Washington.

More specifically, the invention relates to a new cut-off mechanism for culling the reel end of the wire after completion of the twisting of the wire by the machine to form a conventional wire "tie."

★ ★ ★

No. 2,877,809, APPARATUS FOR FORMING WIRES, patented March 17, 1959 by Richard S. Zapf, La Grange, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The apparatus is adapted to form predetermined U-shaped bends in positions along lead wires of electrical resistors.

★ ★ ★

No. 2,877,845, WIRE SEVERING MACHINES, patented March 17, 1959 by Robert T. Cameron, Clifton, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania.

Fixed and slidable cutters cooperate to sever a portion of wire of predetermined length from the work piece to create two severed ends of equal length.

★ ★ ★

No. 2,878,582, APPARATUS FOR HANDLING COILED ROD BUNDLES, patented March 24, 1959 by Maurice P. Sieger, Bridgeville, Pa., assignor to United Engineering and Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania.

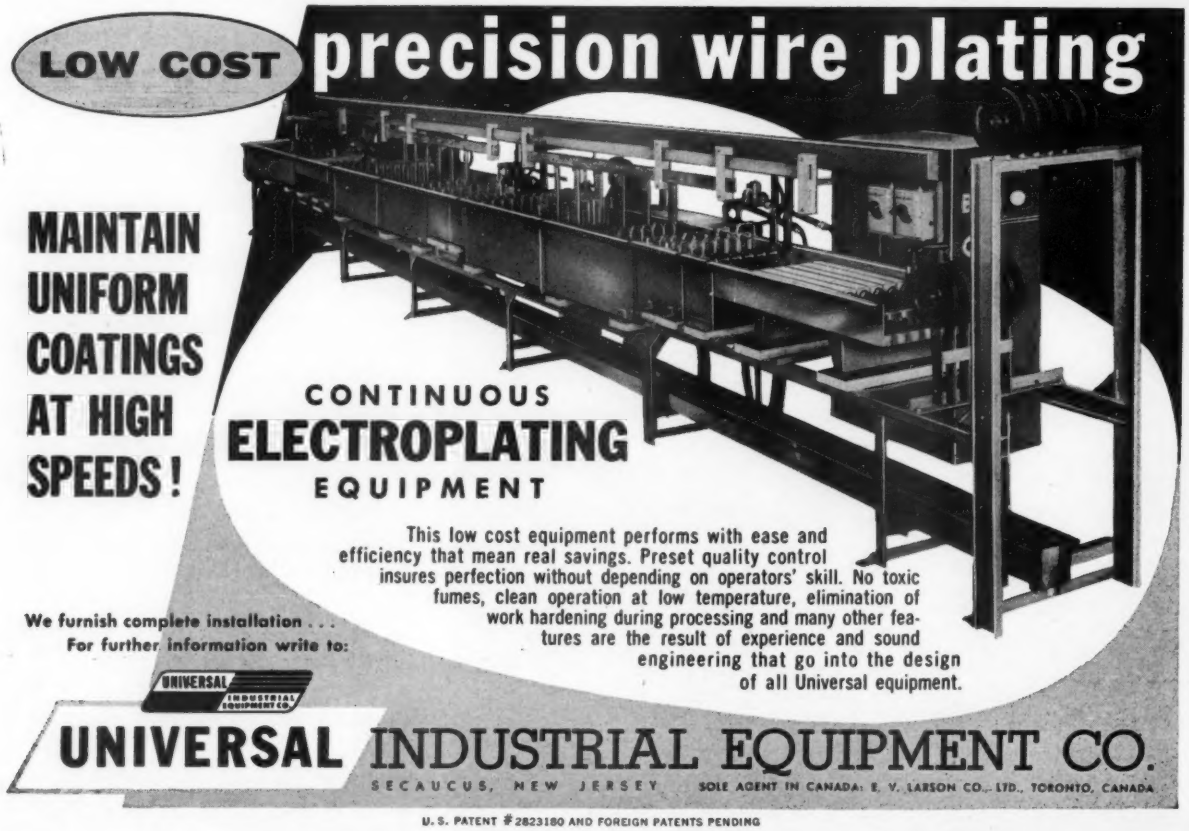
Endless conveyors are provided on one of which the coils are first placed with their central axes extending in a vertical direction and from which they are tilted to deposit upon a second endless conveyor and from which they are removed in sequence to a third endless conveyor.

★ ★ ★

No. 2,879,834, WIRE SPRING STRUCTURE, patented March 31, 1959 by William H. Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Bedford, Ohio, a corporation of Ohio.

A wire spring unit is disclosed

(*Please turn to page* 629)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(*Continued from page 594*)

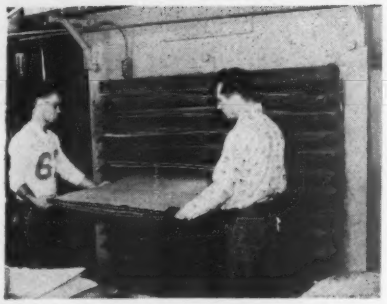

Fig. 8—Sheets are placed one upon the other according to the reel flange thickness required, the grain of each running at right angles to adjacent ones for added strength. The plies are then subjected to heat and pressure to assure good adhesion.

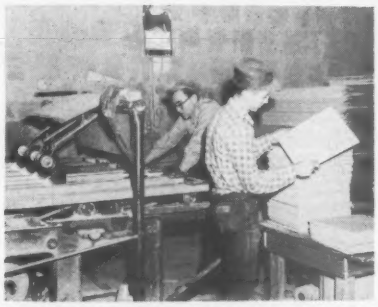

Fig. 9—Plywood thus made is cut to size, sanded, inspected, and is then ready to be formed into reel heads.

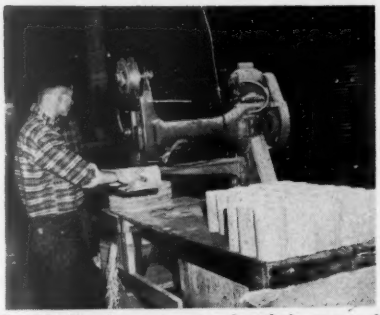

Fig. 10—Forming one type of reel drum.

The accompanying photographs provide a step by step picture-story of how the wood is processed into plywood and then made into spools and reels.

★ ★ ★

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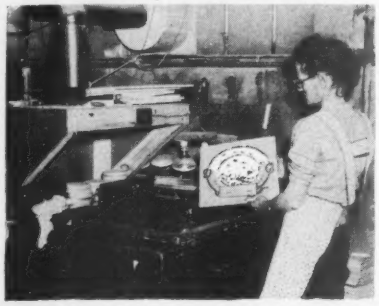

Fig. 11—Here is shown the painting of a reel with a customer's name. Most Carris reels are used for wire.

Fig. 12—The final stage of manufacture—assembly. Reels shown are a non-returnable type.

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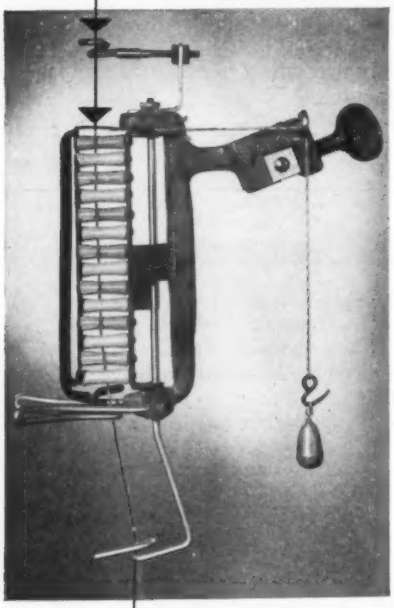

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Booklet on Barrel Processing

New information on barrel processing operations is being gathered rapidly with the continuing growth of this method of manufacture. Compilation and dissemination of such information is necessary to keep technical literature in up-to-date form.

★ ★ ★

The booklet, "Permag Compounds for Barrel Processing" was issued last year, containing indexed information on processes, materials, and case histories. Supplemental sheets have been prepared in the same form for insertion in that book.

★ ★ ★

This information covers several new compound-abrasive materials used alone or with usual large media to provide better cutting, deburring and flash removal. Case histories cover such subjects as deburring of aluminum, steel forgings and zinc die castings. Also covered is the coloring of steel stampings, aluminum castings, and bronze. These new items are noted on a supplemental index.

★ ★ ★

Copies of the sheets or the complete book are available from the manufacturer, **Magnuson Products Corp.**, 50 Court St., Brooklyn 1, N. Y.

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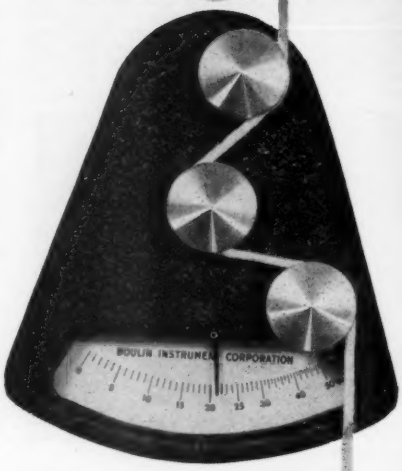

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Styles, gauges, construction features, heights, etc., for these Page products are listed along with typical installation photographs.

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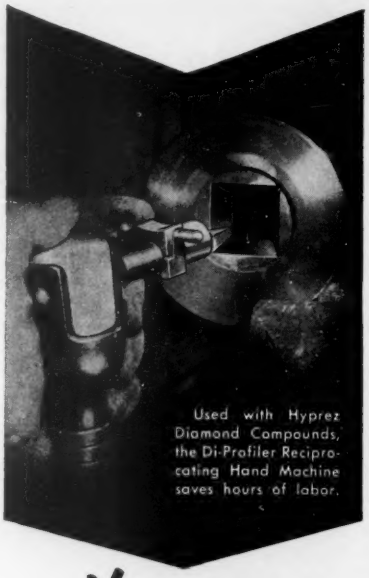
WIRE AND WIRE PRODUCTS

The Wire Man's Magazine



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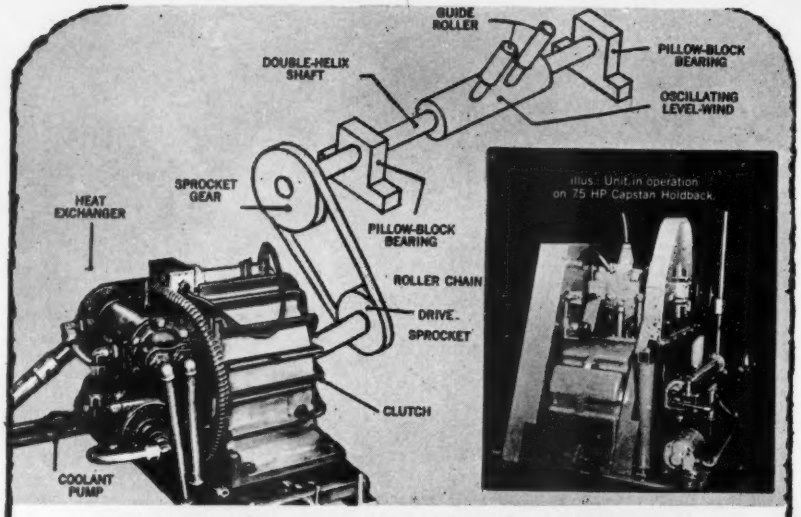

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Thermal Stress-Cracking of Polyethylene II

(*Continued from page* 593)

ence in cracking time in comparison with specimens that were not heat polished.

★ ★ ★

In an effort to further differentiate between the thermal stress-cracking behavior of the 0.96 and 0.92 density polymers, the following experiment was performed. Dumbbell specimens of each of these polymers were extended 30 per cent, placed in glass tubes and thoroughly evacuated and flushed with pre-purified nitrogen. The tubes were placed in an air oven controlled at 150°C and continuous observation was made while the samples heated. It was noted that the high density polymer cracked open in about twenty-five minutes with no evidence of melting, while the low density polymer merely softened and flowed. This again emphasizes that the high density polymers are highly susceptible to thermal stress-cracking whereas the low density polymers do not appear to be affected.

★ ★ ★

It is recognized that when polyethylenes are heated for extended periods of time they may become brittle due to gross changes in crystalline texture. When this occurs a specimen will exhibit brittle fracture when flexed. However, at the point in time when thermal stress-cracking occurred in specimens of the 0.96 density polymer, the material could be flexed repeatedly even adjacent to the thermal stress-crack without causing brittle fracture. Thus, the thermal stress-crack phenomenon occurred long before any heat embrittlement was evident.

★ ★ ★

All the above experiments were ones in which an external stress was applied to the polyethylene prior to testing. One sample of an injection-molded telephone handset was made from 0.96 density polyethylene. This handset, which presumably contained "frozen-in" molding strains, was placed in a

glass tube, thoroughly evacuated and flushed with pre-purified nitrogen and placed in an air oven controlled at 70°C. Although no external stress was applied, the sample cracked in a period of one hundred and fourteen hours (Fig. 3). Presumably the "frozen-in" strains induced in the molding process were of great enough magnitude to cause the handset to thermally stress-crack.

Conclusions

Under comparatively low strains (up to 50 per cent), the high density (0.96 g/ml) polyethylene thermally stress-cracked in essentially uniaxial tension in the same manner as in the helical-wrap test. This is not at variance with the earlier proposed hypothesis involving elastic distortion of spherulites. In both tests the limiting value of strain, as well as the time to failure at various strain levels, was about the same. Further, from approximately 10 per cent strain to 50 per cent strain, there was no significant change in the time to failure.

★ ★ ★

Observations have shown that thermal stress-cracking and heat embrittlement, which is presumably due to gross changes in crystalline texture, are different phenomena.

★ ★ ★

Further testing has substantiated the fact that high density polyethylenes are quite susceptible to thermal stress-cracking, while low density polyethylenes do not appear to be affected.

★ ★ ★

It also appears that thermal stress-cracking can occur in molded parts containing "frozen-in" strains.

★ ★ ★

References

1. Heiss, J. H., and Lanza, V. L., Wire and Wire Products, *33*, 1182-87, (1958).

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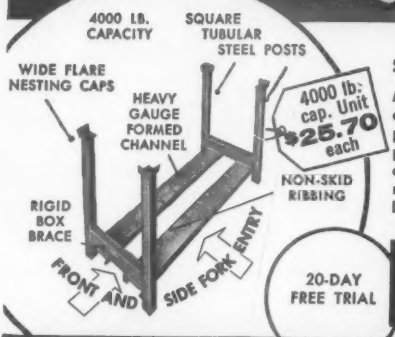

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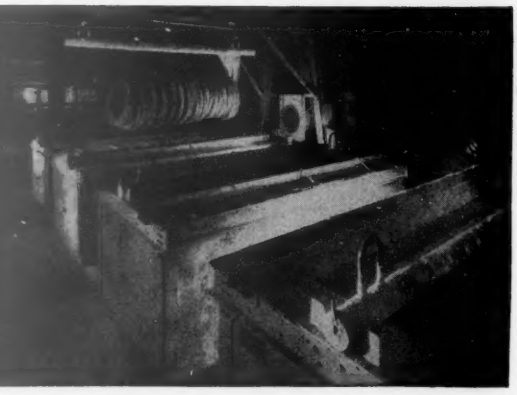

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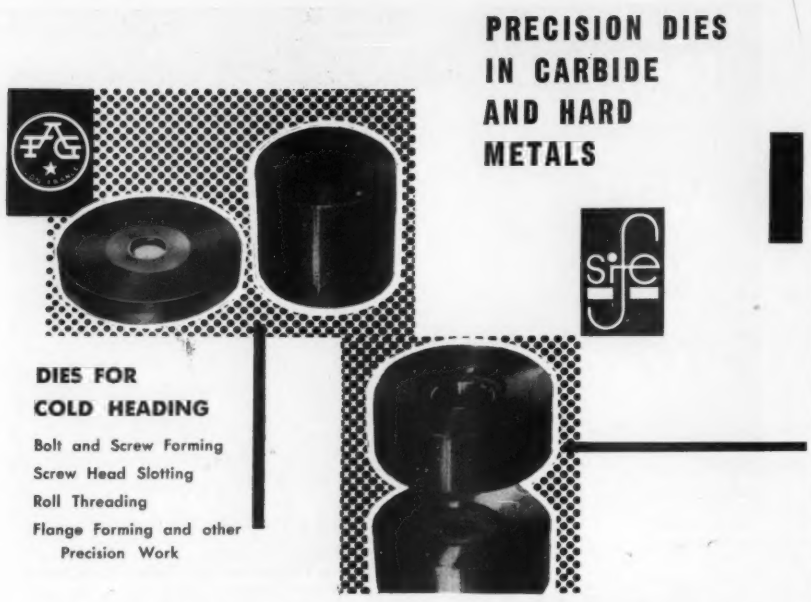

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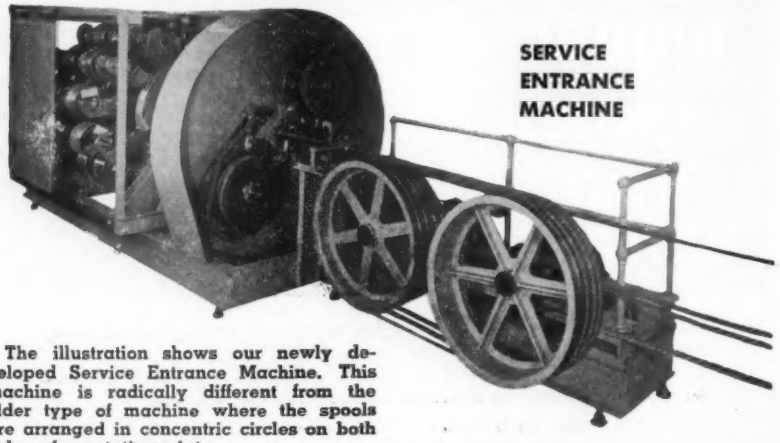
EDMANDSCO WIRE TWISTING MACHINES



SERVICE ENTRANCE MACHINE

The illustration shows our newly developed Service Entrance Machine. This machine is radically different from the older type of machine where the spools are arranged in concentric circles on both sides of a rotating plate.

Here all spools are mounted in mandrels, supported at either end in antifriction bearings and all placed the same distance from the center. Each spool has its own adjustable tension device.

The wire leaving the spool passes over a large sheave, then thru its own guide tube to the space plate and closing die.

This construction permits large spools to be used and enables the unit to run at high speeds.

The taping head can be either eccentric or concentric, as may be desired, with pad sizes to meet customers' requirements. Drive is thru a variable speed device.

Capstans are dual 30 inch diameter 4 groove with rates of lay controlled by change gears.

Write For Further Information On This Interesting Machine

THE EDMANDS CO. 860 WELLINGTON AVE.
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Electrical Resistance Characteristics of Polyvinyl Chloride Formulations

(*Continued from page* 580)

tionship of volume resistivity and insulation resistance measurements. Where such information is available, volume resistivity data could be used to compute the probable I.R. level for specific wire constructions, insulated with a given material.

★ ★ ★

Figure VIII shows the graphical

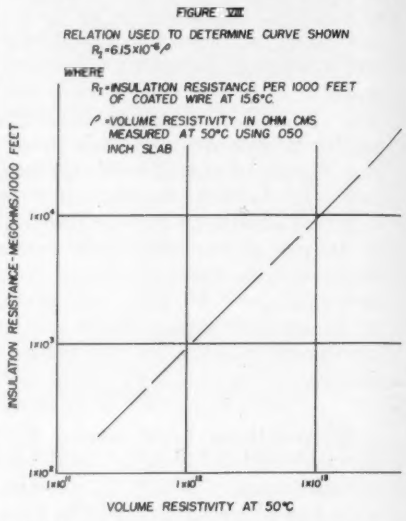
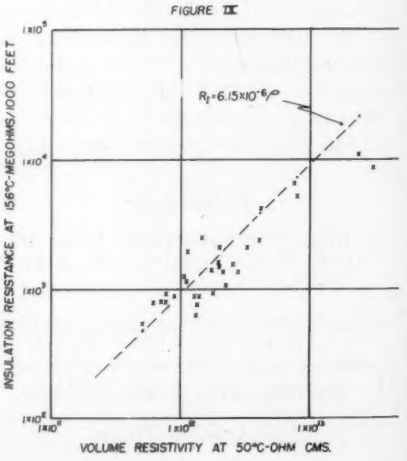


FIGURE VIII
RELATION USED TO DETERMINE CURVE SHOWN
$R_I = 6.15 \times 10^{-6} \rho$
WHERE
R_I = INSULATION RESISTANCE PER 1000 FEET OF COATED WIRE AT 15.6°C
ρ = VOLUME RESISTIVITY IN OHM CMS MEASURED AT 50°C USING .050 INCH SLAB
INSULATION RESISTANCE-MEGOHMS/1000 FEET
VOLUME RESISTIVITY AT 50°C

relation between the volume resistivity and insulation resistance for Opalon 1102 extruded on #24 AWG solid copper conductor with a .0225 inch wall. Values of volume resistivity are at 50°C and insulation resistance at 15.6°C.

★ ★ ★

Figure IX illustrates actual ex-



perimental data obtained on thirty-one separate samples of Opalon 1102, which represent different pigments or pigment lots in each case. The V.R. at 50°C is plotted against the 1 day I.R. at 15.6°C. The agreement between calculated I.R.'s and actual I.R.'s is sufficiently good to justify using V.R. data at the test conditions as a basis for accepting or rejecting specific pigment lots.

★ ★ ★

Under appropriate conditions where good agreement can be shown between insulation resistance values calculated from volume resistivity data and actual short term (1 day) I.R. results, the calculated values could be used in another fashion. The observation has been made that I.R. measurements on long cable lengths may fall below the I.R. level of shorter samples of wire from the same reel due to occasional minor imperfections in the insulation. Calculation of an insulation resistance value from volume resistivity data would, under these circumstances, indicate the potential level of electrical performance of the insulation rather than the actual electrical resistance. In other words, the calculated results could be used as an indication of the efficiency of the insulating process, and changes in its level would be of significant help for process control purposes.

Acknowledgement

The assistance of **M. Friefeld** in planning the testing program and directing the sample preparation is gratefully acknowledged. The cooperation of **G. Urban** in the molding of the test sheets and **G. Dinnie** in the measurement of the dielectric properties and preparation of the graphs is appreciated.

A Review of Recent Wire Patents

(*Continued from page 622*)

embodying two zig-zag-shaped wire springs, each of which includes three substantially parallely arranged, yieldingly spaced resting portions of different length. These springs are arranged in symmetrical and inverted relation with respect to each other to form a wire spring unit having elongated, yieldingly spaced top and bottom resting portions.

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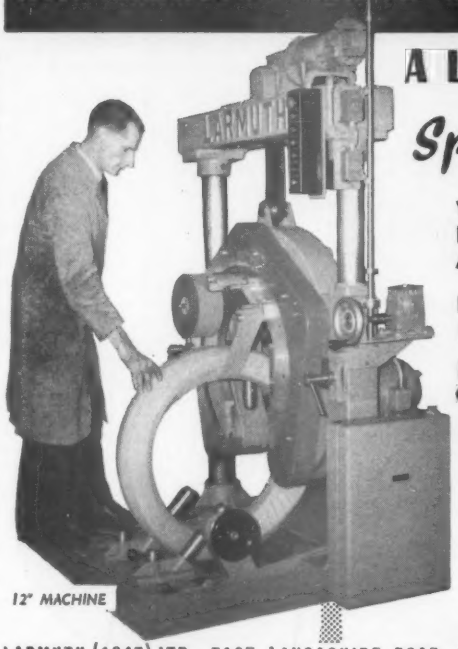

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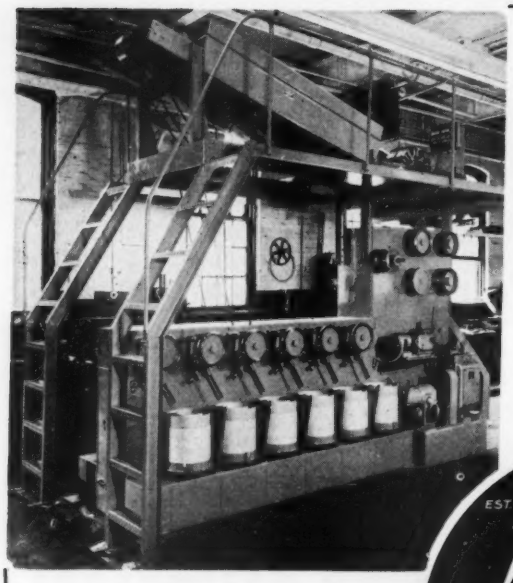

Left: **Barrell Take-up No. 1237, B&S Gauge 20 to 30, for enameling machine with preannealer.**

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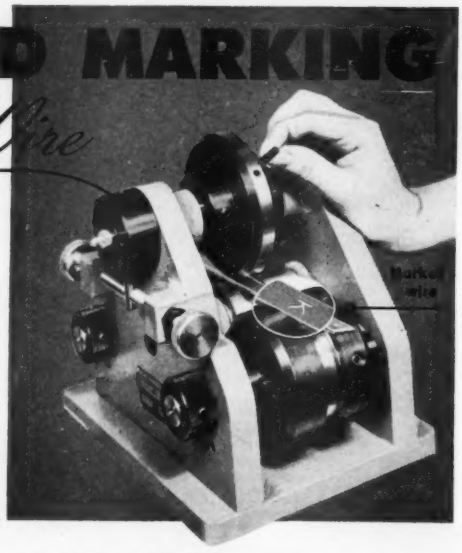

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★ ★ ★

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★ ★ ★

Dr. Anton de S. Brasunas, MEI director, personally handles preliminary steps in setting up company-sponsored study groups, including selection of subject or combination of subjects for a tailor-made course, correspondence with the group instructor, and supervision of class progress.

★ ★ ★

The in-plant brochure, as well as the MEI catalog, may be obtained on request by writing to **Metals Engineering Institute,** Dept. RV-1, 7301 Euclid Ave., Cleveland 3, Ohio.

German Machine Manufacturers Establish U. S. Office

Maschinenfabrik Herborn, manufacturers of wire drawing equipment, and **Wafios Maschinenfabrik,** spring and wire forming machine manufacturers, have each incorporated sales companies in this country to be known respectively as **Herborn Machinery Corporation** and **Wafios Machinery Corporation.**

★ ★ ★

Both concerns will have their U. S. offices at 61 Hudson St., Hackensack, N. J., and will be under the management of **Robert H. Geiss,** who formerly serviced the accounts in this country through the **Kurt Orban Company.**

★ ★ ★

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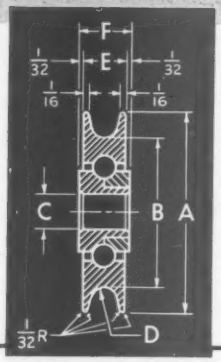

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SBP-20	1 1/4	7/8	1/4	3/32	3/8	7/16
SBP-22	1 3/8	1	1/4	3/32	3/8	7/16
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New Tire Reinforced with Wire

B. F. Goodrich Tire Co., a division of The B. F. Goodrich Company, has started production of a steel cable truck tire that gives up to 20 per cent more mileage than conventional truck tires.

★ ★ ★

The new tire, called the "Power Express Steel Cable," uses steel cords to reinforce the rubber carcass instead of the textile cords. Thirty-nine high tensile steel filaments, .0058 inch in diameter, are twisted to form each of the hundreds of cords in the tire carcass. Each of the cords has a minimum tensile strength of 355 pounds, giving the tire unusually great strength and stability.

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Installs Wide Steel Mesh Equipment

New machinery to produce wide steel mesh has been installed at the Gadsden, Alabama, plant of **Republic Steel Corporation,** according to **C. W. Barrett,** Southern district manager.

★ ★ ★

With the new facilities, mesh up to 13 feet in width can be made. Formerly the width limit was 9½ feet. The new machine can "weave" mesh for buildings and for concrete pipe reinforcement as well as for pavement. It can turn out mesh of various spacings, using transverse wires from 12 to 4/00 gauge. The two other smaller machines will continue to be operated.

★ ★ ★

All three machines are in the Gadsden plant's wire mesh department, formerly known as the Truscon plant. The department produces steel joists and reinforcing bar products as well as wire mesh. Installation of the new facilities required the enlargement of the department's building by approximately 30,000 square feet. Production on the 13-foot machine started in April.

Wire Kinks

(*Continued from page* 601)

through Hartford, Conn., through New York City, and to Los Angeles, which is exactly 3,000 miles. Lay one mile per day, or over 10,000 per day. You will have a backache every day, but pay no attention. Immediately upon reaching Los Angeles start back to Manchester and lay another line end to end alongside the first line. Then turn around and do it again—to Los Angeles. To lay the entire billion dollars it will be necessary to make 32 trips. The "sidewalk" of dollar bills will be seven feet wide. And you will be 265 years older.

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Ultrasonic Cleaning of Fine Wire Drawing Dies

(*Continued from page* 596)

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★ ★ ★

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★ ★ ★

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Capacity Measurement—A Method for Wire Mills

(*Continued from page* 586)

(2) **Acheson J. Duncan, Ph.D., *Quality Control and Industrial Statistics*, Richard D. Irvin, Inc., Illinois, 1955, pp. 109.**

(3) **E. L. Grant, *Statistical Quality Control*, McGraw-Hill Book Company, Inc., New York, 1952.**

(4) ***Op. Cit.*, Table B, p. 612.**

(5) **Carl A. Bennett and Norman L. Franklin, *Statistical Analysis in Chemistry and the Chemical Industry*, John Wiley and Sons, Inc., New York, 1954.**

(6) **L. Kolar (Czechoslovakia), "Determination of Correct Baking Procedures for Enamelled Wires," *Engineer's Digest*, October 1955, Volume 16, Number 10, London, pp. 477-8.**

(7) **H. Kalpers, (Germany), "Electrically Heated Machines for Enamelling Wire," *Electrowarme-Tech*, January 1954, Volume 5.**

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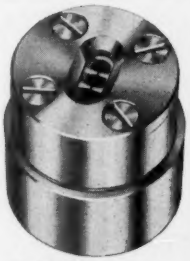

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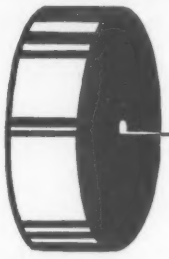

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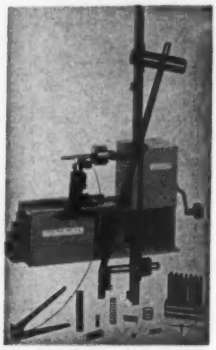

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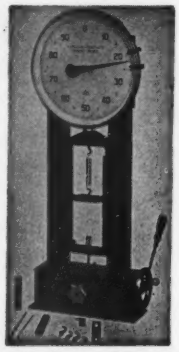

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Measurements of Temperature in Wire Drawing with a Wire Drawing Die Thermocouple Using a Hard Metal Ball Core

(*Continued from page* 575)

core was near 60° C. In the case of steel b) the maximum temperatures were between 320 and 400° C, the cooling water temperatures in the draw plate box near 19 to 23° C, and the temperature of the ball core near 620° C. The high fluctuations of temperature cannot be observed, in this case, as the sheet of the recorder in this test moved too slowly. However, it can surely be suspected that there will be rather considerable interferences in temperatures.

★ ★ ★

As mentioned at the beginning it was the aim of this essay to find a way of measuring in which the influences of the different drawing conditions on the temperatures are exactly shown, and in which the tests can be made in any factory at all drawing speeds, considering the normal working conditions.

★ ★ ★

The results show that the ball core, connected with a wire die type thermocouple is very suitable for such tests. All index numbers have been found at unchanged working conditions and in a normal process of production, and are therefore real practical results.

★ ★ ★

It is most important that the surface temperatures of the water cooled hard metal ball could be stated. The perfection of cooling, i.e., that the water directly surrounds the core, is not provided in common drawing dies. In the most favourable cases the heat emission results, with direct cooling of the draw plate, from the core when it is mounted in the cooling water. In case of indirect cooling heat emission is still more unfavourable.

★ ★ ★

The determinations showed that with rising drawing speeds the temperatures also rise.

★ ★ ★

At speeds of 8 or 10 m/sec., respectively, temperatures of 170° - 180° C were measured, though the

hard metal ball was directly cooled. These values can double on account of sudden temperature rises, which last only one thousandth part of a second.

* * *

In case the cooling fails, which happens rather often in practice, the core at once takes the surface temperature of the wire—in this case 320 - 370° C.

* * *

These considerable amounts of heat must be radiated into the cooling water by the die.

* * *

This shows that real care should be taken when mounting the hard metal cores.

* * *

It is evident that the core must fit closely in the draw plate bordering. If—by negligence, when mounting the hard metal blanks—the core does not fit in the walls of the draw plate, heat will be dammed up which, together with

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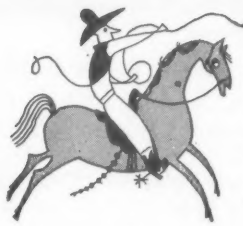

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(*Continued from page* 590)

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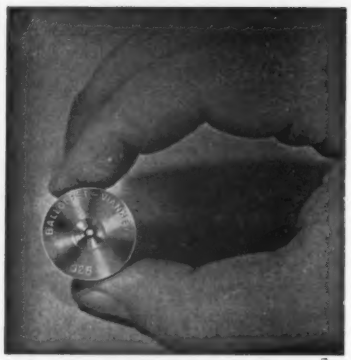

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Index to Advertisers

A

Acrometal Products, Inc. 576
Advanced Wyrepak Co., Inc. 552
Ajax Electric Company 616
Ajax Industrial Supplies, Inc. 636
Amchem Products, Inc. 548
American Insulating Machinery Company 630
American Laubscher Corporation 559
American Pulley Company, The, Hubbard Spool Division 570
American Steel & Wire Division of United States Steel .. 546 and 547
American Woodworking Company 637
Apco Mossberg Company 604

B

Balloffet-Vianney Wire Die Co., Inc. 636
Behr Machinery & Equipment Corp. 635
Blane Corporation, The ..... 550 and 551
Boulin Instrument Corporation 624
Boulin, Victor J., Inc. 636
Brenon, Inc. 636
Bridge Manufacturing Company 545

C

Carl Mayer Corp., The 627
Carlson Company, The 634
Carpenter Steel Co., The Webb Wire Div. 637
Carris Reels, Inc. 556
Cary Chemicals Inc. 530
Celanese Corporation of America, Chemical Division 543
Central Tool and Machine Co., Wire Tool Division 633
Century Dispersions, Inc. 632
Cleveland Tramrail Division,
The Cleveland Crane & Engineering Co. 637
Colbourne Machine Co. ..... 636, 637 and 638
Collins Bros. Machine Co. 631
Continental Steel Corporation 605
Cook Manufacturing Company 538
Coulter & McKenzie Machine Co., Inc., The ..... Inside Front Cover

D

Danforth, C. W., Co. 636
Daniels & Co., Frank 633
Davis Electric Co. 522
Davis-Standard Division of Franklin Research Corporation 563
Durant Manufacturing Co. 637
Durkee Mfg. Co., Inc. 637
Dykrex Corporation of America 626

E

Eastern Carbide Corp. 636
Edmands Co., The 628
Elgin National Watch Company, Abrasives Division 591
Emory, Robert J. Company 637
Engis Equipment Co., Hyprez Division 625
Enjaco Corporation 613
Entwistle Manufacturing Corporation 562

F

Fenn Manufacturing Company, The 609
Fisher Associates 637
Fort Wayne Diamond Products, Inc. 636
Fort Wayne Wire Die, Inc. 636

G

Gem Gravure Co., Inc. 632
General Engineering Company (Radcliffe), Limited 558
General Tire & Rubber Co., The, Chemical Division 523
Gillies, Duncan M., Co., Inc. 602
Glader, Wm., Machine Works 611

H

Harper Electric Furnace Corporation 621
Haskell-Dawes Machine Co., Inc. 629
Heany Industrial Ceramic Corp. 624
Herborn, Maschinenfabrik 553
Hodge Bros. Machine Shop 637
Hoosier Wire Die, Inc. 636
Hubbard Spool Division, The American Pulley Company 570

I

Indiana Wire Die Company 636

J

Jarke Manufacturing Company 627
Johnson Steel & Wire Company, Inc.
Sub. of Pittsburgh Steel Company ..... 528 and 529

K

Kelly Wire Die Corporation 636
Keystone Steel & Wire Company 537

L

Larmuth & Bulmer, Limited 581
Larmuth (1947) Ltd. 629
Lewis Machine Company, The 623
Litzler Co., Inc., C. A. 606

M

Magnuson Products Corporation 633
Malin & Company, The 633
Matthews & Co., Jas. H. 630
Metallurgical Products Department, General Electric 541
Mettler Machine Tool, Inc. 557
MH Machines, Morgardshammar Mek Verstads AB 569
Michigan Oven Company 632
Micro Products Company 542
Miller, R. H. Company, Inc. 572
Molded Fiber Glass Tray Co. 637
Monsanto Chemical Company, Plastics Division 540
Montgomery Co., The 634
Morgan Construction Company 524
Mossberg Pressed Steel Corporation, Division of Wanskuck Co. .. 620

N

National Machinery Exchange 637
National Research Company 632
National Wire Die Co., Inc. 636
Naugatuck Chemical Division, United States Rubber Company ... 561
New England Butt Company, Division Wanskuck Company 566
New England Wire Die Co. 636
New York Engineering Company 531
Niederrheinische Huette A. G., Kurt Orban Company, Inc. 634
Northern Indiana Steel Supply Co., Inc. 568
Norton Company 617
Norton & Co., Ltd., Sir James Farmer 535

O

Ofenbau Fritz, G.m.b.H. & Co., K. G. 612
Orban, Kurt Company, Inc., Niederrheinische Huette A. G. 634

P

Pacific Coast Borax Company,
Division United States Borax & Chemical Corporation 625
Pan American Supply Company ..... 534 and 549
Parkin Chemical Co., The 637
Pittsburgh Carbide Die Co. 636
Pittsburgh Steel Company,
Johnson Steel & Wire Company, Inc., subsidiary ..... 528 and 529
Platt Bros. & Co., The 637
Porter, Inc., H. K. 608
Pourtier Pere et Fils 614

R

Reicher, Paul—Schlatter, H. A., Ltd. 619
Republic Steel Corporation ..... 564 and 565
Rivom 628
Robinson, M. W., Company, Inc. 525
Roebling's, John A., Sons Corporation 555
Royle, John & Sons 618
Rusch Wire Die Corporation 637

S

Scott Testers, Inc. 637
Scovill Manufacturing Company 532
Scudder, E. H., Foundry & Machine Co. 637
Sjogren Tool & Machine Co., Inc. 615
Sleeper & Hartley, Inc. 610
Stamford Processing Co. 637
Standard Industrial Compounds Co., Inc. 521
Standard Mill Supply Company 635
Steel Equipment Company 533
Steel & Wire Machinery Co. 637
Sunbeam Equipment Corporation 554
Superior Tool & Manufacturing Co. 635
Swift & Company, Industrial Soap Dept. 539
Syncro Machine Company ..... Back Cover
Syracuse Bearing Co. 631
Synthetic Thread Corp. 631

T

Takemura & Co., Ltd. 631
Terkelsen Machine Company 637
Torrington Manufacturing Company, The 544
Twitchell, E. W., Inc. 607

U

United States Borax & Chemical Corporation,
Pacific Coast Borax Company Division 625
United States Rubber, Naugatuck Chemical Division 561
United States Steel, American Steel & Wire Division .... 546 and 547
United Wire and Supply Corporation 603
Universal Industrial Equipment Co. 622
U. S. Industrial Chemicals Co., Division of
National Distillers and Chemical Corp. 527

V

Vaughn Machinery Company, The ..... Front Cover

W

Wafios Maschinenfabrik 536
Waterbury-Farrel Foundry & Machine Co., The,
Division of Textron, Inc. 598
Watson Machine Company, The ..... Inside Back Cover
Wayne Wire Die Co. 635
Webb Wire Division, The Carpenter Steel Co. 637
Web Controls Corp. 626
Western Wire & Textile Machinery, Inc. 635
Wheelabrator Corporation 560
Whitacre Engineering & Manufacturing Company 526
Wilson, Lee, Engineering Company, Inc. 567
Wire & Textile Machinery, Inc. 634

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Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rivom, Dijon, France
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Wayne Wire Die Co., Linden, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit.
Rivom, Dijon, France

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
Indiana Wire Die Company, Fort Wayne, Indiana
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rivom, Dijon, France
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Wayne Wire Die Co., Linden, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Marking and Stamping
Jas. H. Matthews & Co., Pittsburgh, Pa.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.

DIES—Roll Threading
Rivom, Dijon, France

Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Rivom, Dijon, France

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rivom, Dijon, France
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Wire Packaging
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A. Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Galvanizing Equipment
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Harper Electric Furnace Corporation, Buffalo, N. Y.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Resistance Heating, Strand
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS —
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
The General Tire & Rubber Company, Akron, Ohio.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The. Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Takemura & Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Takemura & Co., Ltd., New York, N. Y.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Chain Making
Larmuth and Bulmer, Limited, Manchester, England
Pan American Supply Company, New York, N. Y.
Steel & Wire Machinery Co., Cleveland, Ohio
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Closing Cable
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden.
National Mach'y Exch (Used), New York
Steel & Wire Machinery Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn
Pan American Supply Company, New York, N. Y.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany
Pangborn Corporation, Hagerstown, Md.

MACHINERY—Diameter Control
Daystrom-Weston, Industrial Gauges, West Englewood, N. J.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
General Machine Tool Co., Worcester, Mass.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Flat Wire
General Machine Tool Co., Worcester, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Manufacturing Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
EVG., Machinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY — Measuring Diam., Insulated Wire
Daystrom-Weston, Industrial Gauges, West Englewood, N. J.

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Paper Clips
Pan American Supply Company, New York, N. Y.

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Pin Making
Takemura & Co., Ltd., New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Printing on Electric Wire
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Machine Tool Co., Worcester, Mass.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Ring Forming
Pan American Supply Company, New York, N. Y.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Peschel Electronics, Inc., Towners, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Special
General Machine Tool Co., Worcester, Mass.

MACHINERY—Spooling Tension Controls
Web Controls Corp., West Englewood, N. J.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells Company, Frank L., Kenosha, Wisc.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY— Staple Making
Pan American Supply Company, New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York 19, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Düsseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Kraft, J. A., Maschinenfabrik, OLPE/Westf. Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing for Dielectric Faults
Peschel Electronics, Inc., Towners, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)

Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
E. V. G., Maschinen and Stahl, A.G., Zurich, Switzerland
Schlatter, Ltd., H. A., Zollikon/Zurich

MACHINERY—Wire Weaving
Takemura & Co., Ltd., New York, N. Y.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
General Machine Tool Co., Worcester, Mass.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York 19, N. Y.
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKensie Machine Co., Bridgeport, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Wire and Machinery Co., Cleveland, Ohio
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Takemura Co., Ltd., New York, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wire Engineering Associates, Inc., South Holland, Ill.

MACHINERY—Wire Forming
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Takemura Co., Ltd., New York, N. Y.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp., New York, N. Y.
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Company, Boston, Mass.

MARKING & STAMPING DIES—(See DIES—Marking and Stamping)
Jas. H. Matthews & Co., Pittsburgh, Pa.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Machine Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
Amchem Products, Inc., Ambler, Pa.

PAPER—Insulating
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Frank Daniels & Co., New York, N. Y.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Mettler Machine Tool, Inc., New Haven, Conn.
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New York Engineering Corp., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
New York Engineering Corp., Yonkers, N. Y.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLLS—For Flattening Wire
General Machine Tool Co., Worcester, Mass.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TENSION METERS—for Wire
Boulin Instrument Corporation, Pelham, N. Y.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Moesberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WAXES—for Insulated Wire
Cary Chemicals, Inc., New Brunswick, N. J.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
E. V. G., Maschinen and Stahl, A.G., Zurich, Switzerland
Micro Products Co., Chicago, Ill.
H. A. Schlatter, Ltd., Zollikon-Zurich

WHEELS—for Printing on Electric Wire
Frank Daniels & Co., New York, N. Y.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Malin & Co., The, Cleveland, Ohio
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Montgomery Co., The, Windsor Locks, Conn.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
National Lock Washer Company, The, Newark, N. J.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's John A., Sons Corp., Trenton, N. J.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
American Chain & Cable, Page Steel Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Synthetic Thread Corp., Bethlehem, Pa.

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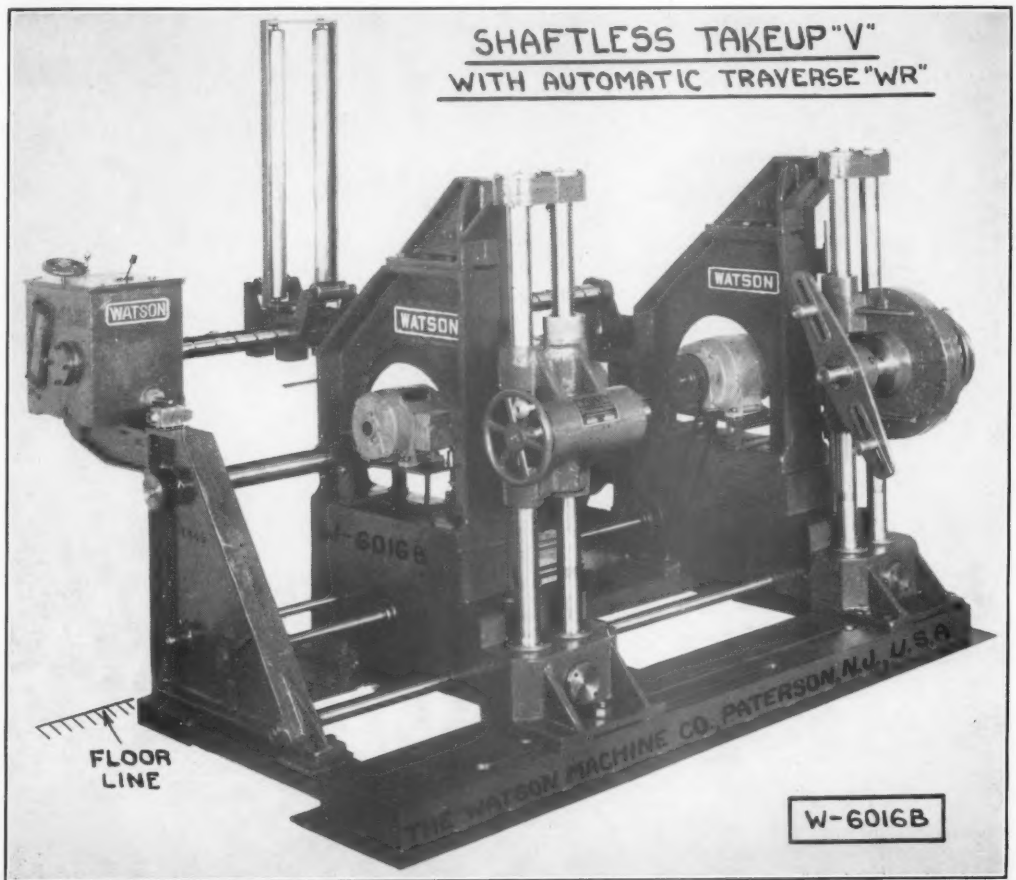

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Self-contained spooler unit; commutator type annealing contactors; increased wire cooling capacity; self-contained heat exchanger; greatly reduced floor space requirements—just five of the many fine features incorporated in Syncro's new RESISTONEAL Model AB-3S. Highest speeds make this unit the pace-setter for electric resistance annealing of copper wire in combination with Syncro Models A, B, and BG high speed wire drawing machines producing wire sizes from 26 to 36 B&S gauge.

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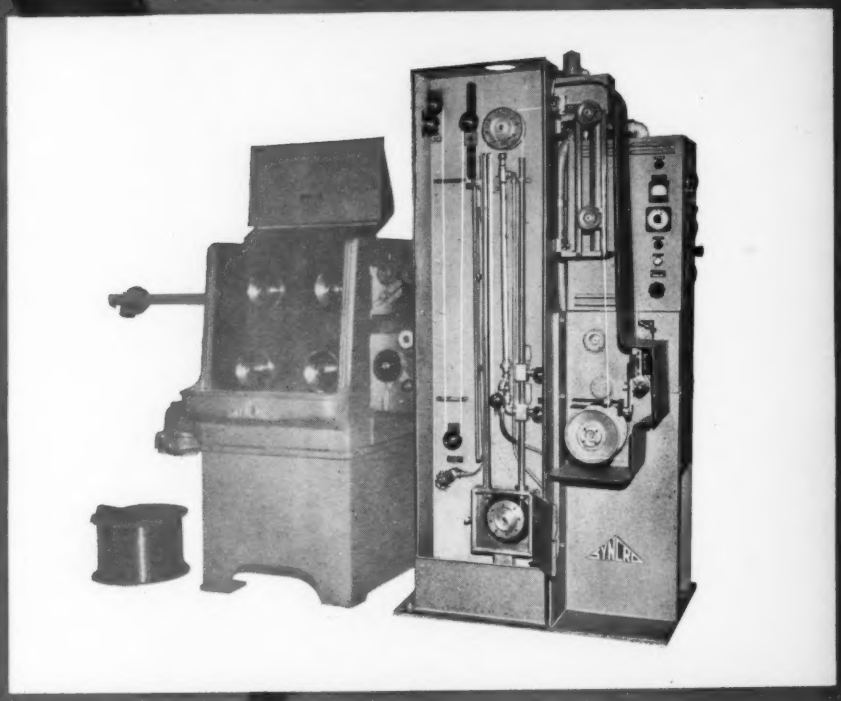

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